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DEPARTMENT OF THE AIR FORCE

SUPPORTING DATA FOR FISCAL YEAR 1986 BUDGET ESTIMATES

SUBMITTED TO CONGRESS FEBRUARY 1985

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DESCRIPTIVE SUMMARIES

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF THE DEPARTMENT OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM
FY 1986
FEBRUARY 1985

INTRODUCTION AND EXPLANATION OF CONTENTS

1. (U) General. This document has been prepared to provide information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) Program to Congressional Committees during the Fiscal Year 1986 hearings. This information is in addition to the testimony given by DOD witnesses.

(U) The Descriptive Summaries provide narrative information on all RDT&E program elements and projects, except those listed in para 4b, within the USAF FY 1986 RDT&E Program. A Test and Evaluation section is provided for major weapon systems. The formats and contents of this document are in accordance with the guidelines and requirements of the Congressional Committees insofar as possible.

(U) The "RESOURCES" portion of the Descriptive Summaries includes, in addition to RDT&E funds, procurement funds and quantities, Military Construction Appropriation funds on specific development programs, Operation and Maintenance Appropriation funds where they are essential to the development effort described, and, where appropriate, Department of Energy (DOE) costs.

(U) Pages 1040-1046 are in response to the Senate Appropriations Committee requirement contained on page 78 of the Senate Appropriations Committee report (98-292, 1 Nov 83).

(U) The section of the Fiscal Year 1986 Descriptive Summaries, entitled "Facilities Exhibits," (pages 1061-1094) contains information on major improvements to and construction of government owned facilities funded by RDT&E.

(U) Page 1095 is in response to the Senate Appropriations Committee requirement contained on page 78 of the Senate Appropriations Committee report (98-292, 1 Nov 83).

2. (U) Comparison of Fiscal Year 1984 and 1985 Data. A direct comparison of Fiscal Year 1984 and Fiscal Year 1985 data shown in this document with corresponding data in the Program Element Descriptive Summaries dated 1 February 1984 will reveal significant differences. Many of the differences are attributable to the following factors:

a. (U) Fiscal Year 1985 reductions as a result of Congressional action on the appropriation.

b. (U) Fiscal Year 1984 funding changes between October 1, 1983 and September 30, 1984 due to RDT&E Reprogramming Actions.

c. (U) Reclassification of Fiscal Year 1984 and Fiscal Year 1985 data to achieve comparability with the program structure for Fiscal Year 1986.

3. (U) Relationship of Fiscal Year 1986 Budget Structure to the Fiscal Year 1985 Budget Approved by the Congress.

PROGRAM ELEMENT	REMARKS
BUDGET ACTIVITY 1: TECHNOLOGY BASE	
61103F University Research Initiative	New program proposed for FY 1986
62206F Civil Engineering and Environmental Quality	New program element for effort previously included in program element 62601F
BUDGET ACTIVITY 2: ADVANCED TECHNOLOGY DEVELOPMENT	
63107F Automation of Technical Information	New program proposed for FY 1986
63217F Weapon Systems Power	New program deferred by the Congress in FY 1985 budget
63313F Advanced Missile Subsystems Demonstration	New program deferred by the Congress in FY 1985 budget
63363F Hypervelocity Missile	Continuing program zero funded in FY 1985 by the Congress
63406F Advanced Military Spaceflight Technology	New program deferred by the Congress in FY 1985 budget
63454F Non-Destructive Inspection Development	New program proposed for FY 1986
BUDGET ACTIVITY 3: STRATEGIC PROGRAMS	
12323F Tactical Warning/Attack Assessment Interface Network	New program proposed for FY 1986
33152F World-Wide Military Command and Control (WWMCCS) Information System	New program element for effort previously included in program elements 63735F and 33154F
64234F Common Strategic Rotary Launcher	New program element for effort previously included in program element 63258F
BUDGET ACTIVITY 4: TACTICAL PROGRAMS	
27419F Tactical Airborne Command and Control Systems	New program proposed for FY 1986

44011F Special Operations Forces	New program for support equipment for systems previously developed in program element 64753F
64219F Integrated Digital Avionics	New program element for effort previously included in program elements 64753F and 63203F
64236F Infrared Search and Track System	New program element for effort previously contained in program element 63203F
BUDGET ACTIVITY 5: INTELLIGENCE & COMMUNICATIONS	
33112F Air Force Communications	New program proposed for FY 1986
BUDGET ACTIVITY 6: DEFENSE-WIDE MISSION SUPPORT	
64237F Variable Stability In-Flight Simulator	New program element for effort previously contained in program element 62201F
65874F Product Performance Agreement Center	New program proposed for FY 1986
72207F Depot Maintenance	New program proposed for FY 1986
78031F Logistics Command, Control, Communications and Intelligence (C^3I)	New program element for effort initiated in FY 1985 in program element 63106F
91212F Service-Wide Support	New program proposed for FY 1986
91215F Productivity Investments	New program proposed for FY 1986

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TECHNOLOGY BASE

ELEMENT CODE	TITLE	PAGE
61101F	In-House Laboratory Independent Research	1
61102F	Defense Research Sciences	5
61103F	University Research Initiative	31
62101F	Geophysics	32A
62102F	Materials	37
62201F	Aerospace Flight Dynamics	45
62202F	Aerospace Biotechnology	53
62203F	Aerospace Propulsion	60
62204F	Aerospace Avionics	67
62205F	Training and Simulation Technology	78
62206F	Civil Engineering and Environmental Quality	85
62302F	Rocket Propulsion	89
62601F	Advanced Weapons	93
62602F	Conventional Munitions	99
62702F	Command, Control and Communications	108
62703F	Personnel Utilization Technology	116

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63107F	Automation of Technical Information	127

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63203F	Advanced Avionics for Aircraft	137
63205F	Flight Vehicle Technology	141
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63211F	Aerospace Structures and Materials	152
63215F	Aviation Turbine Fuel Technology	157
63216F	Advanced Turbine Engine Gas Generator (ATEGG)	160
63217F	Weapon Systems Power	164
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63231F	Crew Systems Technology	174
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63245F	Advanced Fighter Technology Integration (AFTI)	181
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63410F	Space Systems Environmental Interactions Technology	217
63424F	Missile Surveillance Technology	220
63452F	Very High Speed Integrated Circuits (VHSIC)	222
63454F	Non-Destructive Inspection Development	225
63601F	Conventional Weapons	227
63605F	Advanced Radiation Technology	231
63704F	Manpower and Personnel Systems Technology	237
63707F	Weather Systems	240
63718F	Electronic Warfare Technology	243
63723F	Civil and Environmental Engineering Technology	249
63726F	Fiber Optics Development	255
63727F	Advanced Communications Technology	257
63728F	Advanced Computer Technology	261
63743F	Electro-Optical Warfare	266
63745F	Chemical Warfare Defense	270
63750F	Counter-Countermeasures (CCM) Advanced Development	273

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63752F	DOD Software Engineering Institute	280
63789F	Command, Control and Communications Advanced Development	283
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63364F	Short Range Attack Missile II (SRAM II)	291
63716F	Atmospheric Surveillance Technology	294
63735F	Worldwide Military Command and Control Systems (WWMCCS) Architecture	297
64226F	B-1B	300
64234F	Common Strategic Rotary Launcher	311
64312F	Intercontinental Ballistic Missile (ICBM) Modernization	315
64326F	Strategic Conventional Standoff Capability	338
64361F	Air Launched Cruise Missile (ALCM)	343
64406F	Space Defense Systems	350
64711F	Systems Survivability (Nuclear Effects)	360
11113F	B-52 Squadrons	362
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11213F	Minuteman Squadrons	377
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63239F	Advanced Tactical Air Reconnaissance System (ATARS)	495
63256F	Joint Service Advanced Vertical Lift Aircraft (JVX)	498
63307F	Air Base Survivability and Recovery	501
63320F	Lower Cost Antiradiation Seekers	504
63609F	Millimeter Wave Seekers	506
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64220F	Electronic Warfare Counter Response	544
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64223F	Alternate Fighter Engine	550
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64236F	Infrared Search and Track System (IRSTS)	559
64247F	Modular Automatic Test Equipment (MATE)	562
64249F	Night/Precision Attack	565
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64313F	Next Generation Trainer	575
64314F	Advanced Medium Range Air-to-Air Missile (AMRAAM)	582
64321F	Joint Tactical Fusion Program	592
64362F	Ground Launched Cruise Missile (GLCM)	596
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64602F	Armament/Ordnance Development	611
64604F	Submunitions	616
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64738F	Protective Systems	669
64739F	Tactical Protective Systems	675
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65306F	Ranch Hand II Epidemiology Study	976
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FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101F
DOD Mission Area: #510 - Defense Research

Title: In-House Laboratory Independent Research
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		13,069	15,000	17,444	21,167	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Science and Technology program provides discretionary funds to the Laboratory Directors to use on targets of opportunity or high-risk efforts that occur during the year. The Deputy for Advanced Technology in the Office of the Assistant Secretary of the Air Force (Research, Development, and Logistics) determines the distribution of funds to the various laboratories based on the results of the previous year's efforts.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	13,069	16,826	19,755		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Not Applicable.

5. (U) RELATED ACTIVITIES: Efforts accomplished through this program are an important and integral part of the total work being done in the Air Force Laboratories. Funds are used to start or expand particularly promising work and continue for one year or until the work is transitioned to the regular program. The responsibility for utilizing Laboratory Director's Fund (LDF) funds rests with the Laboratory Directors. Similar programs are funded by the Army and Navy.

6. (U) WORK PERFORMED BY: Numerous small and moderate size contracts are placed with universities and industry each year, in conjunction with directly related in-house laboratory efforts, to investigate promising new research areas. Directors of the Air Force in-house laboratories are supported by and participate in this program. The five major contractors were: Gould, Inc., Cleveland OH; Systems Research Laboratories, Inc., Dayton OH; Syracuse University, Syracuse NY; United Technologies Corp., West Palm Beach FL; Hughes Research Laboratories, Malibu CA. There are 135 additional contractors doing work under 162 contracts.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 61101F, In-House Laboratory Independent Research

A. (U) Project Description: The purpose of this program is to provide discretionary authority to Laboratory Directors of the Air Force Systems Command for new research work judged to be of high promise or importance. The Air Force has set up and administered this program in strict compliance with the intent that it would be unencumbered by restrictive reviews and procedures, or justification and documentation prior to beginning work. Laboratory Directors meet annually with the Assistant Secretary of the Air Force for Research, Development, and Logistics to account for their research projects.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments:

a. (U) Single Crystal HUD CRT Development: The use of single-crystal faceplate cathode ray tubes (CRTs) for use in high-brightness head-up display (HUD) was investigated. The usual powdered-on-glass faceplate was replaced by a single-crystal faceplate consisting of a substrate plate on which an epitaxial doped layer had been grown. The Single Crystal CRT development has been highly successful, providing significant breakthrough in the state-of-the-art. It is considered likely that this technology will transition to HUD applications without further government development work. The most near-term candidate for transition of the technology appears to be the F-15E, dual role fighter.

b. (U) Bistatic Synthetic Aperture Radar Experiment: This project took advantage of a unique opportunity in conjunction with NASA, to demonstrate at extremely low cost how spaceborne radar technology can be utilized in terrestrial bistatic radar applications. The design and preparation for this experiment had to be pursued with urgency since the shuttle mission had a fixed schedule.

c. (U) Graded Index Coatings for High Energy Laser (HEL) Mirrors: This effort was completed with the development of a synthesis technology necessary to coat single crystal silicon substrates for high energy laser mirrors with rugate or graded refractive index dielectric coatings to enhance their reflectivity and damage threshold. The technology base established under this effort has provided technical understanding and direction to current Air Force and Army programs to develop rugate filters.

d. (U) Rapid Scan Flaw Detection Method for Adhesive Bonded (A/B) and Composite Structures: This analytical and experimental work examined the effect of flaws on vibrational modes of bonded joints. Results show that it is possible to construct an acoustic frequency non-destructive evaluation (NDE) instrument to rapidly scan both metal and composite bonded structures in order to detect and size flaws at the critical edge of the joint.

e. (U) Multi-Action Die Cold Forming Process: This program evaluated the production potential for a forging process utilizing independently programmable dies and rams to precision form small metal parts. The results of this study indicate there are too few Air Force, even DOD, applications to justify additional work in this area.

f. (U) Evaluation of a Novel Catalyst System for Producing Jet Fuel from Whole Shale Oil: Working with the Amoco Oil Company, the results of this effort indicate that a 76 weight-percent yield of JP-4 boiling range material could be achieved by processing a dearsenated Occidental whole shale oil at 0.44 LHSV (liquid hourly space velocity), 2000 psig, and about 780°F using a dual catalyst system with a two year useful lifetime, by increasing the reactor temperature only 25°F over that two year period. This program has made a significant addition to the fuels processing technology data base and several patents have resulted.

g. (U) Pulsed Energy Storage for Railguns: The program objective was to demonstrate the feasibility of cryogenically cooled metals for lightweight inductive energy storage for railguns. The results of this program will be used to establish an exploratory development effort for fabrication of a multi-megawatt inductive energy storage coil.

h. (U) Laser Threat Models: The overall objective of this effort was to design, develop, and document an integrated survivability assessment methodology which simulates a tactical engagement of a surface based laser weapon system against an airborne target. The Laboratory Director's Fund (LDF) portion of this project consisted of a survey to gather and assess existing subsystem methodologies/models, a data base for applicability to this effort, and the identification of methodology voids which exist.

i. (U) Hazardous Space Plasma Detection: The objective of this LDF initiative was to develop, fabricate, test and calibrate an advanced detector capable of simultaneously measuring in space the energy and angular distribution of electrons and ions with energy between 10 eV and 30,000 eV. Results from this work are being actively applied to the production of flight instrumentation for the Space Radiation experiment for the Combined Release/Radiation Effects Satellite (CRRES) and the Interactions Measurements Payload for Shuttle (IMPS).

j. (U) Fluid Dynamics of Spinning Rocket Motors: This program provides the experimental verification of an inertial wave/spacecraft coning interaction which is believed to have caused flight anomalies experienced in several satellite launches. This work verified the basic thesis that coupled mechanical/inertial wave instabilities can contribute to the development of coning oscillations of a spinning spacecraft if the rocket chamber has the appropriate shape.

k. (U) Magneto Plasma Dynamic (MPD) Thruster Mission Study: The objective of this study was to identify future Air Force missions that might benefit from the use of MPD electric propulsion and then to quantify those benefits by a comparison with chemical propulsion. The study concluded that MPD thruster systems provide launch mass benefits of up to 50 percent over chemical systems for both primary and auxiliary propulsion.

l. (U) Environmental Effects of Air Force Fuels and Chemicals: The overall objective of this effort was to assess the effect of Air Force fuels and chemicals on atmospheric, aqueous, and soil environments. A teflon reaction chamber was constructed to investigate the air oxidation of hydrazine fuels. This chamber has yielded important new information on the kinetics of surface-catalyzed air oxidation processes involving hydrazine on a number of different surfaces.

(2) (U) FY 1985 Program: The distribution of $14.922 million for FY 1985 was approved by the Assistant Secretary of the Air Force for Research, Development, and Logistics. The Laboratory Directors will again select projects of high promise to be supported during the remainder of 1985

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The program in FY 1986 will continue as in FY 1985. Projects will not be selected until FY 1986.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61102F
DOD Mission Area: #510 - Defense Research

Title: Defense Research Sciences
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		179,076	188,571	206,334	238,987	Continuing	N/A
2301	Physics	20,389	20,343	22,404	26,130	Continuing	N/A
2302	Structures	*	11,609	12,785	14,911	Continuing	N/A
2303	Chemistry	18,110	20,653	22,746	26,530	Continuing	N/A
2304	Mathematics	17,565	18,456	20,326	23,707	Continuing	N/A
2305	Electronics	21,740	20,995	23,122	26,968	Continuing	N/A
2306	Materials	22,491	22,203	24,453	28,520	Continuing	N/A
2307	Fluid Mechanics	24,114	14,326	15,778	18,402	Continuing	N/A
2308	Energy Conversion	10,842	10,925	12,032	14,033	Continuing	N/A
2309	Terrestrial Sciences	2,699	2,780	3,062	3,571	Continuing	N/A
2310	Atmospheric Sciences	11,154	11,915	13,122	15,304	Continuing	N/A
2311	Astronomy & Astrophysics	5,551	7,471	8,228	9,596	Continuing	N/A
2312	Biological & Medical Sciences	8,219	9,829	10,824	12,624	Continuing	N/A
2313	Human Resources	6,159	6,766	7,452	8,691	Continuing	N/A
2917	University Research Instrumentation	10,043	10,300	10,000	10,000	0	50,568

*The Structures research was previously managed under Project 2307.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Science and Technology Base program element exclusively supports Air Force research efforts, comprised of in-house investigations in Air Force Laboratories and extramural activities in academia and industry. It is a broad-based scientific and engineering basic research program dedicated to the search for new ideas in areas pertinent to the Air Force mission: aerospace structures and aerodynamics, materials, propulsion and power, electronics, computer science, directed energy and conventional weapons, life sciences, and terrestrial, atmospheric and space sciences. The program is committed to providing the fundamental basis for future development activities in military aerospace technology. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI). Increased funding in FY 1986 will be used to pursue promising new research directions ($8 million), to increase support to work begun in FY 1985 ($4 million), and to capitalize on opportunities afforded by results obtained in the continuing program ($6 million). Important new areas are: (1) Air Combat Maneuverability (Project 2307) will exploit new ideas in unsteady aerodynamic

behavior including the post-stall flight regime in order to enhance the air combat effectiveness of fighter aircraft. (2) Control of Distributed Parameter Systems (Project 2304) will establish the fundamental body of knowledge required for pointing and tracking of large space structures, rapid redirecting of flexible structures, wavefront control of high power lasers, shape control of space antennas, and active flutter suppression. (3) Monolithic Millimeter Wave Integrated Circuits (Project 2305) research will investigate device design rules, semiconductor material architectures, and automated processing techniques for fabricating single chip circuits for use in surveillance, target tracking, electronic warfare, and secure communications. The objective is to reduce cost, improve performance and reliability, reduce size and weight, and provide new capabilities. (4) Work begun in FY 1985 in Fast Algorithms and in Turbine Engine Hot Section Research will be expanded in order to exploit the potential of emerging new multiprocessor computer architectures by establishing techniques for large scale nonserial computation, make advances in combustor technology to significantly improve thrust-to-weight performance and maneuverability, and increase mission range with concommitant reduction in maintenance costs. (5) Recent scientific progress in nonmetallic materials, in particular polymers and glasses, the physics and chemistry supporting laser technology, novel electromagnetic material concepts, and human sensory performance will also be exploited by broadening the scope of the research being supported by this program element.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Estimate	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	179,441	190,115	218,460		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Program coordination among government agencies is achieved through annual interagency meetings and data exchange with the Army, Navy, National Science Foundation, Department of Energy, National Aeronautics and Space Administration, Federal Aviation Administration, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and other Federal research activities. Other means of coordination include annual briefings to the Under Secretary of Defense for Research and Engineering, attendance at technical symposia and topical reviews covering research areas of common interest, and other activities such as the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Propulsion Committee. In addition, particularly effective coordination is accomplished on an informal basis among individual Air Force program managers and their counterparts in other agencies.

6. (U) WORK PERFORMED BY: The Air Force basic research program is conducted in Air Force laboratories and under extramural grants and contracts with academic institutions and industry. The entire research program is managed by the Air Force Office of Scientific Research, Bolling AFB, DC. Research is now underway in-house at the Air Force Wright

Aeronautical Laboratories, Wright-Patterson AFB, OH; Air Force Armament Laboratory, Eglin AFB, FL; Air Force Weapons Laboratory, Kirtland AFB, NM; Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; Air Force Geophysics Laboratory, Hanscom AFB, MA; Air Force Human Resources Laboratory, Brooks AFB, TX; USAF School of Aerospace Medicine, Brooks AFB, TX; AF Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH; Frank J. Seiler Research Laboratory, USAF Academy, CO; and the Rome Air Development Center, Griffiss AFB, NY. The five major contractors for FY 1984 were: Stanford University, Stanford, CA; University of California, primarily at Berkeley and Los Angeles, CA; Massachusetts Institute of Technology, Cambridge, MA; University of Southern California, Los Angeles, CA; and the Southeastern Center for Electrial Engineering Education, Inc., St Cloud, FL. In FY 1984, there were 340 contractors with 1,100 contracts or grants, with a total value of $132 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: This program element has fourteen projects. Three of these projects, 2309, 2311, and 2313, are under $10 million in FY 1986. However, full descriptions of these projects are included below to provide the full scope of the Air Force Defense Research Sciences Program.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2301, Physics

A. (U) Project Description: This project provides scientific information to the technology base to help solve Air Force problems in new weapon systems development, electromagnetic countermeasures, nuclear weapons effects, nondestructive and nonintrusive testing and analysis, and new materials development. To provide the necessary scientific knowledge, work is supported in optical physics, plasma physics, atomic and molecular physics, particle beam technology, and physics of collective phenomena.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) A laser operating at a wavelength of 93 nanometers has been demonstrated and analyzed. This is the first known direct laser transition operating at a wavelength below 100 nanometers and the only laser to operate between so-called core atomic states. New understanding of very high intensity radiation which has led to this accomplishment indicates that further research could lead to production of intense coherent X-rays down to the region of one nanometer. (2) New major advances have been made in the study of laser induced chemistry at surfaces and the application of these phenomena to electronic device and materials processing. It has been demonstrated that direct write laser deposition techniques can be used for real time, free form interconnection of silicon gate array circuits, with real time, in situ testing. This may greatly increase production yield as faulty chips can be diagnosed and corrected during fabrication. Further use of laser direct etching techniques and real time circuit corrections or modifications can be made with no loss in circuit performance. This research may find applications in lithography and may result in the manufacturing of ultra-high speed integrated circuits. (3) A metastable diatomic negative helium ion was discovered, the existence of which had not been previously

predicted. This ion is apparently the simplest possible negative molecular ion, and its existence will permit important tests of quantum mechanical calculations of the properties of molecules. The knowledge obtained from this research is vital to the development of large pulsed power sources, excimer laser modeling, and large scale particle accelerators. (4) Magnetic insulation and efficient beam transport of high current proton beams were demonstrated for the first time. These are necessary preconditions for producing short duration, high current, high energy ion beams for directed energy applications.

(2) (U) FY 1985 Program: A major effort aimed at very short free electron laser wavelengths is being maintained. Recent developments give reasonable confidence that wavelengths of 20 nanometers or less can be achieved. The electron beam apparatus, when completed, will also be available to test visible free electron laser concepts. Multiphoton pumping of atoms using subpicosecond, extremely high brightness excimer laser radiation is the subject of major investigations. The anomalously high efficiency coupling of the radiation into atomic excitation is being investigated theoretically and experimentally, and X-ray laser concepts based on these interactions are being pursued. Novel optical devices based on recent understanding of the growth mechanisms of single crystal optical devices are being explored. Research into energy conversion processes for future multimegawatt space-based electric power systems is continuing, with emphasis on thermionic, thermoelectric, and novel thermophotovoltaic processes. Negative ion source physics continues to be a strong research thrust, with emphasis on experimental studies of volume generation of intense, cold negative ion beams. Studies of the propagation physics of high current electron beams are receiving less emphasis, while combined experimental and theoretical studies of plasma beam generation, equilibria, and propagation are being expanded. Efforts are being maintained in favor of quantum mechanical/statistical mechanical, theoretical research aimed at the formulation of valid partition functions from which the physical parameters of the pre-and post-detonation constituents can be derived. Three basic research thrusts are in X-ray laser sources, novel microwave sources, and superconductivity. The superconductivity research is directed toward the understanding of superconductor performance in fast repeating pulse coils and a determination of the limits of repetition rate for superconducting switches at high power transfers.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: A new initiative is planned on the excitation/pumping processes in electric discharge lasers with the ultimate goal being the discovery of metastable atoms or molecules suitable for the efficient pumping of new visible/UV lasers. Extreme ultraviolet and X-ray source programs will continue, programs in X-ray optics will be enhanced, and new studies based on these sources and optics will be undertaken. Laser induced surface chemistry techniques will be applied to microwave and millimeter wave devices. Ultrafast (picosecond and subpicosecond) light pulses will be applied to the generation of millimeter waves for studying the characteristics of monolithic millimeter wave circuits and for gaining understanding and devising techniques which could lead to the use of ultrashort light pulses for production testing of monolithic circuits. In the multimegawatt space prime power area, research on conversion of thermal energy to electricity and on thermal management of waste heat will continue. Research to establish the physical limits of capacitive and inductive energy storage in space, aimed at achieving compact, light weight, gigajoule level energy storage will receive greater emphasis. Research in plasma switching for pulsed power will begin the transition to exploratory development, while work on solid state opening switches will be expanded. In the area of particle beams, studies on endoatmospheric

propagation of high current electron beams will be transitioned to development programs. Plasma beam studies will continue, with emphasis on detailed measurements of beam propagation characteristics and on source scaling analyses and propagation theory. Quantum/statistical mechanics treatments will be enhanced to deal with more complex chemical species. New plasma physics thrusts will be investigated in the area of intense-field particle accelerators. Continued analysis of X-ray, ultra-violet, and microwave/millimeter wave emission from novel sources will continue with the emphasis redirected toward specific military applications.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2302, Structures

A. (U) Project Description: This project pursues research directions supporting aerospace structures, including structural dynamic-control interactions, nonlinear modeling and analysis, constitutive modeling and fatigue, and fracture prediction of metals, composites, and geotechnic materials. The results of this work provide the generic technologies with new concepts necessary to assure the design and operational performance of superior aerospace weapon systems and installations.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) A new finite element and computational strategy has been devised for the transient nonlinear analysis of shells with large deformations. The new methods can address impact-type loading and are valid well into post-buckled deformation response. This allows structural materials to be used in configurations in which the post buckling strengths are used to achieve structural weight reductions of 20 percent or more. (2) A unified method for predicting matrix dominated damage state development in structural composite laminates was achieved. The method, based on fundamental fracture models and a stochastic description of damage state development, has been experimentally verified under both static and fatigue loading. This is the first fundamental analytical model which can predict interaction effects between different matrix cracking modes and is providing significant insight into the damage development process. (3) A practical and accurate computational technique to model the post cracking stress-strain behavior of concrete was demonstrated for the first time. The post crack load carrying capability of a concrete structure significantly affects the survivability of hardened structures. This technique will allow more accurate assessment of survivability and faster development of greatly improved design techniques.

(2) (U) FY 1985 Program: The structural durability portion of the program emphasizes damage growth prediction methods for composite laminates, critical in the design of damage tolerant and durable aerospace structures, and development of methods for analysis of inelastic crack growth behavior in fatigue. The effects on dynamic response

of large motion and deformation associated with aircraft maneuvers and spacecraft control are being evaluated. The use of passive and active control for managing dynamic response to ensure adequate performance and durability margins is being pursued. Environmental effects from thermal and electromagnetic radiation, and micro-meteorite impact and penetration, are being investigated. Preliminary studies of the deployment dynamics of lattice type space structures are underway. Studies are continuing to determine load transfer to a structure by surrounding geological materials following explosions. Effort is being placed on the ability of partially saturated soils to carry loadings to structures, on properties easily measured with the soil in place, and to understand the mechanisms of micro-cracking and plastic flow in rock. Efforts are also continuing to characterize the constitutive behavior of plain and reinforced concrete under a broad range of load intensities and strain rates.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Structural durability efforts will emphasize quantitative descriptions of the mechanisms underlying damage growth relative to long life behavior. In composite laminates, the thrust will be toward integrated measures of damage in gradient fields. Crack closure and plastic wake effects on fatigue damage growth in metals will be studied. Strong emphasis will be placed on models recognizing the stochastic nature of the damage growth process. The structural mechanics efforts will emphasize statistical modeling and life prediction. The interaction among the dynamic response, thermal deformations, and controls, particularly for spacecraft systems, will be addressed. Efforts aimed at identifying new approaches to the analytical simulations of spacecraft on-orbit deployment dynamics will continue. These efforts should lead to future research involving microprocessor technology for simulation of spacecraft on-orbit dynamics. Emphasis will be placed on the response of structures to blast loadings, particularly high intense close-in loading conditions. The behavior of materials designed to resist close-in blast events, such as high strength concrete, will be continued. Materials for aircraft operational surfaces will be carefully studied as will the systems in which they reside. Special attention will be applied to the behavior of soils subjected to the unique under-pavement loading environment. Both these efforts will support economy of maintenance and construction of main operating bases and contingency bases as well as rapid runway repair. Efforts will continue to define the effects spatial and temporal variations of soil properties have on soil strength and behavior.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2303, Chemistry

A. (U) Project Description: Research in chemistry supports a broad range of Air Force technology requirements in materials, electronics, geo-environmental characterization, weaponry, and propulsion and power. Major components include the synthesis and characterization of lower cost, higher performance nonmetallic materials for application as structural composites, lubricants, sealants, and hydraulic fluids, as well as a detailed description of atomic scale

interfacial contamination responsible for limitations on the lifetime and performance of electronic devices. Also being investigated are atmospheric reaction chemistry influencing the reliability and sensitivity of Air Force satellite-borne surveillance and detection systems, molecular level energy conversion processes fundamental to high energy laser development, and electrochemical reactions underlying development of lighter weight, higher energy content batteries.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Higher strength, higher modulus ordered polymer fibers have been readily synthesized and formed. High oxidative stability, high tensile strengths of 600,000 psi, low forecast cost per pound, and high compressive strength (2/3 that of graphite) have been measured. Aggregate films of a highly thermal stable polymer were processed and found to have an intrinsic electrical conductivity comparable to graphite. This indicates that this type of polymer could be used in electro-optic applications. (2) Dense, flat specimens of silica glass have been produced. Comparable glass structures have now been made with variable composites of silica, thoria, titania, lithia, and alumina. The earlier problem of specimen cracking has been eliminated with the aid of special additives that control polymerization and assure fine, uniform pores in the gel and eliminate differential pressures during drying. The overall process has transitioned to an exploratory development program to demonstrate its feasibility for large scale optical mirrors for deployment in space manufactured to operational configuration without weeks of annealing to relieve internal stresses and little or no final polishing. (3) A new chemical source for silicon carbide has been demonstrated. The related synthesis process requires two reaction steps instead of the four needed with the old process, as well as a temperature of only 1500F instead of the current 2300F. It promises a more uniform product, higher yield, and lower cost. Recent research has discovered effective cross-linking agents to obtain strong, three-dimensional structures as opposed to only fibers. (4) The feasibility of iodine monofluoride (IF) as a chemical laser emitting in the visible spectrum has been fully demonstrated. Various means to chemically pump IF or energize lasing are under investigation. The most promising source is electronically activated nitrogen molecules transferring their energy to IF by molecular collisions. This system is an attractive candidate for compact, light weight space lasers.

(2) (U) FY 1985 Program: The four areas of emphasis within the overall program are non-metallic structures, synthetic methods, surface phenomena, and molecular kinetics. Non-metallic structures, such as polymers, glass, ceramics, and advanced composite concepts research is the area of most rapid growth. Future payoff includes new materials for structural, optical, and electronic applications. Research in synthesis seeks not only new materials such as polymers, elastomers, fluids, and propellant ingredients, but more efficient, lower cost routes to existing materials. Research in surface chemistry seeks to interpret microscopic physical phenomena on the scale of individual atoms that are responsible for the overall performance and reliability of thin film electronic devices. Efforts in molecular kinetics address the rates and mechanisms of chemical reactions, the dynamics of energy redistribution, and spectroscopy. Past emphasis continues in the discovery and evaluation of candidate chemical laser systems that will emit visible radiation. The same detailed, molecular level phenomena may be used to interpret sources for infrared radiation in the upper atmosphere. Understanding the source allows accurate prediction of time dependent intensities

of radiation background at various wavelengths. Over the past two years, major increased emphasis has been placed on materials concepts for large scale space structures. A new thrust was initiated on nonmetallic materials for optical signal processing. Investment was also increased in energetic binders for propellants and explosives. This fiscal year, a major new program will be launched to seek high temperature, high strength, tough ceramic composites for the materials needs of higher performance turbine engine hot sections.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Areas of special emphasis initiated over the past three years, short wavelength lasers, molecular composites, solution ceramics, electro-optical materials, and energetic polymers, will continue. Within these general areas, significant new approaches are planned. Solution ceramics, or low temperature sol-gel processing, will include nitride compounds using non-aqueous solvents. Emphasis in low density, monolithic ceramics for large-scale spacecraft will change to high temperature, oxidation resistant, high strength, tough ceramic/ceramic composites. Special emphasis will be placed on the rates, and possible catalysis, of the polymerization and densification of porous gels. In response to the recognized need for future advances in combustion efficiency, a major initiative in research on chemical kinetics is projected. Research in ordered polymers will reach the stage of injection molded, small scale molecular composites. As this goal is reached, the effort in structural materials can be transitioned to exploratory development. Consequently, greater emphasis can be placed on electro-optical and electronic properties of nematic, rigid rod polymers of the same general family as those used as structural materials. Applications for these organic solids are foreseen in non-linear optical devices and in microelectronics.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

11. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2304, Mathematics

A. (U) Project Description: The research in mathematical sciences seeks discoveries of mathematical and computational ideas to provide understanding and to solve problems of critical importance to the Air Force. The topics include control of aerospace systems; aerodynamic design of aircraft, missiles, or other weapons; efficient production of large-scale, well-documented computer programs and software; communication and information theory; artificial intelligence in surveillance systems or in independent weapons; reliability, availability, and maintainability; and the allocation of resources in logistics or operational activities.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Equipment reliability has long been recognized as a critical factor in its ultimate effectiveness. The Air Force needs to have an accurate assessment of the reliability of equipment before

its introduction into the field. Recently, the most general, and therefore most flexible, mathematical model of equipment deterioration ever built has been formulated. Using this model, an accurate lifetime distribution can be obtained from data on five parameter functions. (2) Important problems such as the determination of flow properties at aircraft flight conditions result in mathematical models which can be solved in a realistic way only by computational techniques. The models are extremely difficult to solve because of their inherent complexities. A new technique under investigation has been shown to ease the computational burden by using intermediate information to concentrate the effort in regions where the solution is undergoing the greatest changes. This approach will allow a more complete modeling of the fundamental physics involved in these challenging problems. This method represents substantial progress in the construction of effective algorithms for large-scale scientific computations. (3) The problem of decentralized control of distributed systems is extremely complicated because each decision maker or controller acts on different information about the state of the system. Such problems are very important in the application areas of command, control, communications, and intelligence (C^3I); defense resource allocation; and computer networks. Recently, a significant result was obtained in the area of dynamic team problems which resulted in the first solution on a non-quadratic team problem. This has in turn produced efficient computational algorithms for computing decentralized gains.

(2) (U) FY 1985 Program: A new initiative in fast algorithms is being undertaken to support research to devise and analyze new algorithms which exploit the potential of existing and emerging architectures of vector and parallel computers for very efficient performance. The success of this initiative may be a key to Air Force capability to capitalize upon current and future generations of computers. The major area of concentration will be on discoveries that will allow much more rapid computations at reasonable cost using the newest, most powerful computers. With the expected results of this research it should become possible to capture more of the significant detail of complex physical problems such as chemically reacting flows. Numerical and analytical techniques for identification, control, and optimization of distributed parameter systems will be supported at an increasing level in the control theory program. These systems provide the basic models of large space structures, deformable mirrors for laser beam control, and aeroelastic flight phenomena including flutter. Much of the work in control theory will lay the groundwork for a major thrust in the study of distributed parameter control problems of ground-based and space-based laser weapons. In statistics and probability, the work in reliability modeling and inference is expected to be increasingly important, and work started under the initiative may be enlarged. Another area of increased emphasis will be research on reduction of complexity of computations in network reliability. Studies on stochastic processes and on nonparametric signal processing will be important. The program in computer science will support further work on the role of artificial intelligence. The research in distributed and parallel processing will be directed into a major role in supporting the initiative in fast algorithms. Current progress in the study of chaotic mathematical behavior is expected to lead to results of value in the quantitative description of mathematical turbulence and to knowledge of how to control mechanical systems that can exhibit chaotic behavior. These advances will be exploited by the research in physical mathematics. There will be an increase in research on multiperson games with cooperative strategies when parameters of the game are unknown to the players. Related methods will be studied for utility in the theory of spread spectrum communication. Research related to very large scale integrated (VLSI) circuits will concern the fault

tolerance of distributed computing systems made up of such processors and the theory of mapping prescribed algorithms onto the switching structure of general VLSI chips using software techniques.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: A major FY 1986 initiative is planned on the mathematics of control of continuous systems. This effort will concentrate on the new methods needed for controlling deformable mirrors and large space structures used in directed energy weapons and for controlling the flutter of aircraft. In addition, related work will be undertaken on high speed algorithms to implement modern digital control for on-board, real time applications and on spectral-modal methods to extend the analytical power of control theory. The initiative on computational methods for computers with nonserial architectures will continue at a high level. The thrust of this initiative will be supported by studies of general computational methods aimed at the difficulties in the numerical simulations of three-dimensional nonlinear differential equations that model flows, flames, and structures. The initiative to improve reliability modeling, inference, and analysis for systems of degrading or repairable components will also continue. Artificial intelligence methods will be emphasized in image understanding, autonomous weapon systems, and expert systems for the efficient production of documented software. The mathematics of signal processing and communication will get increasing attention. New statistical methods to extract the maximum information available from a minimal amount of data will be emphasized. The ready availability of computers for numerical experiments has uncovered new phenomena associated with nonlinear systems. Mathematically understanding these new phenomena in the context of physical examples will be a continuing effort. Central to the goals of the project is support of mathematical and computer science research to resolve increasingly complex issues associated with the fundamental, critical resource of computing.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

12. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2305, Electronics

A. (U) Project Description: Electronics research provides fundamental knowledge required to advance Air Force capabilities in surveillance, guidance and control, information and signal processing, electronic warfare, and communications, command, and control. Research topics include optical signal processing for target recognition and terminal guidance, compound semiconductor devices for high speed digital and analog signal processing, and microwave and millimeter wave signal and power generation. Electromagnetic propagation, antennas, target signatures, microwave tube science, and magnetostatic acoustic and electro-acoustic analog signal processing devices are being studied. Other areas under investigation are integrated optics for advanced inertial guidance sensors, robust communications techniques for command and control, and nuclear radiation hardening of electronic circuits and devices.

3. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Research has been conducted to study a novel real time programmable electro-optic hologram device called a spatial light modulator. It has demonstrated considerable potential for integrated optical signal processing applications, optical beam steering, and programmable-focus power optics. (2) Operation of radars in or near rough terrain produces undesirable clutter which degrades radar performance. Results of previous modeling, based on fine and coarse scales of roughness for estimating surface-induced scatter, have not been satisfactory in many instances. A theoretical technique has been established which permits the accurate calculation of electromagnetic scattering from rough conducting surfaces, thereby contributing to improved design and operation of Air Force radar systems. (3) Previous work in the area of electronic circuit vulnerability indicated that as the dimensions of circuit devices were reduced, the rate of errors and single event upsets due to radiation would increase. An improved analysis of cosmic ray-induced errors revealed that the rate would reach a maximum and then decrease as device density on the chip increased. This unexpected result has led to the analysis of scaling effects on other problems, such as transient upset by X-rays and total radiation dose effects. These analyses produced findings similar to the cosmic ray case. The significant result of this work is the discovery of a radical departure from past approaches to electronic system design for radiation hardness which promises to substantially shorten the lead time for introducing new circuit technologies into Air Force systems. (4) New field effect transistor devices made of layered film structures have been studied to improve low temperature transport characteristics. Detrimental low temperature effects are believed to be caused by injection/trapping mechanisms and limit the current handling capacity of semiconductor devices. The new layered structures have shown a 30 percent increase in low temperature current handling capabilities. This result points the way to substantial speed and frequency improvements in low temperature semiconductor devices.

(2) (U) FY 1985 Program: Major research efforts are underway in optical signal processing materials and circuits that can process massive volumes of data prior to processing by digital integrated circuits of the type being advanced under the Very High Speed Integrated Circuit (VHSIC) Program. This research is building on results that show the potential of these circuits to process a great many streams of data in parallel and achieve extremely high data flow. Primary optical signal processing research will continue, addressing command, control, communications, and intelligence (C^3I) signal processing applications. The program on improved semiconductors emphasizes the use of basic materials research in compound semiconductors such as gallium arsenide and gallium aluminum arsenide in novel optical and electronic device structures. Researchers are pursuing ultra submicron fabrication techniques that have spatial resolution of 100 Angstroms and the promise of time resolution of sub-picoseconds. Programs are continuing in surface acoustic wave and magnetostatic wave research. Emphasis will continue in the areas of space communications, electronics reliability, low cost inertial sensors, information processing architecture in ultrasubmicron electronics, and microwave power tubes. Researchers are studying topics closely related to advanced countermeasures techniques, including deception jamming, terrain scattering, and antenna characterization. Pathfinding research in superconducting analog signal processing will continue.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: A growing research effort in millimeter wave integrated circuitry for analog signal processing will combine with an FY 1984 thrust in optical signal processing for ultrawide bandwidth signal processing. This expands emphasis on preprocessing extremely high rate data for input to semiconductor processors such as those being developed under the very high speed integrated circuit (VHSIC) program. Research on ultra-submicron electronics will focus on increasing the capability to make and characterize electronic circuits and materials with dimensions smaller than those of the VHSIC Program. Now that major breakthroughs have been made in the short term stability of fiber optic ring laser gyroscopes, research on these gyroscopes will shift to improving long term stability. The ultimate goal is to develop these gyroscopes for use in navigation and guidance systems. Materials research will continue to support optical signal processing device investigations. In particular, researchers will investigate optical polymers and the active use of lasers to fabricate and alter signal processing devices. As optical signal processors become more rugged, compact, and lightweight, these devices should be suitable for use in tactical reconnaissance and weapon delivery systems. Research leading to fast parallel processing algorithms and devices for analog to digital conversion will be increased as a part of the FY 1986 Monolithic Millimeter Wave Integrated Circuits initiative. New research looks at devices that can operate in environments in which intense jamming occurs and electronic countermeasures are used.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

13. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2306, Materials

A. (U) PROJECT DESCRIPTION: The materials research program provides the knowledge required for improving the performance, cost, and reliability of structural and electronic materials. The structural materials research program studies a broad range of material properties, such as strength, fatigue resistance, and corrosion resistance of airframe, turbine engine, and spacecraft materials. Emphasis is on titanium, aluminum, and nickel-based alloys, advanced polymers, and ceramics. Research in new production methods and nondestructive evaluation of these materials complements research on materials properties. The electronic materials research program is concerned with semiconductor, optical, and magnetic materials used in avionics, surveillance, communications, guidance, and electronic warfare. Emphasis is on compound semiconductors, superconductors, surface acoustic wave and magnetostatic wave materials, materials for infrared fiber optic systems, nonlinear optical materials for signal processors and high purity quartz for improved frequency stability for use in clocks.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Materials research efforts in titanium metal alloy superplasticity have resulted in a production method for manufacturing complex aircraft components with a high degree of structural

efficiency. Alloys of titanium, which are outstanding structural materials for aerospace application, exhibit superplastic behavior when deformed at slow strain rates at elevated temperatures. Lower superplastic forming temperatures are desirable; however, the essential properties disappear in common alloys at lower processing temperatures. Recent research results have shown that nickel additions to titanium alloys can achieve the desired superplastic properties at substantially lower temperatures, from 1700F to 1500F. This new process could dramatically improve techniques used to form aircraft components. (2) Future high performance electronic devices for computing and electro-optic applications will use new semiconductor material structures. Layered structures composed of different materials, such as heterostructures of gallium arsenide and aluminum gallium arsenide have demonstrated unique properties that will have electronic and electro-optic applications. (3) Researchers are exploring the properties associated with hydrogen-like impurity atoms in quantum well superlattices. The electronic binding energies of hydrogenic impurities were predicted to be a function of the superlattice quantum well dimensions and to significantly differ from bulk values in the same material. The theoretical predictions were verified experimentally and this improved understanding will be useful in designing transistors with significantly higher frequency capability.

(2) (U) FY 1985 Program: Research efforts are continuing on metals and ceramics with potential for improving the high temperature gas turbines used in greater thrust-to-weight ratio aircraft engines. These engines will improve aircraft maneuverability and fuel efficiency. Nondestructive evaluation research seeks to increase the service life and reliability of aircraft engines and airframes, especially those that use new high strength, low weight composite materials. Powder metallurgy research seeks to increase engine durability and reduce the need for critical materials in jet engines. Compound semiconductor research has been redirected from characterization and processing of bulk gallium arsenide to film growth, characterization, and thermal processing of multilayer compounds for high frequency microwave sources and high speed digital signal processors. Growth techniques, such as ionized cluster beam deposition, are being explored for expanded materials growth versatility and the growth of materials that cannot be processed by current techniques. Applications of this research will allow future avionics to function in a hostile electronic warfare environment. Optical detector materials are being improved for surveillance optics, missile seekers, fiber optic communication, and inertial navigation systems. Research in materials for optical storage, optical signal processing, and electro-optics is being increased to enhance our capability to process large volumes of data in real time tactical situations. Materials research is underway to improve the survivability of satellites against laser attack and other antisatellite threats. Manufacturing sciences research investigates robotics for the automatic assembly and test of small batch lots of aerospace assemblies.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Emphasis will increase on research for improved aircraft structural and engine materials, improved understanding of powder metallurgy, protection of carbon-carbon in oxidizing environments, and methods for making new high strength ceramics. Improved synthesis, characterization, and fabrication techniques for electromagnetic materials for the development of new solid-state lasers, faster and more radiation resistant submicron integrated circuits, integrated and fiber optic components, and millimeter wave devices will also receive more emphasis. A thrust in thin film dielectric deposition for enhanced optical and electronic coatings will be increased. Research thrusts will grow in compound semiconductors for monolithic millimeter wave integrated circuits and superconducting films for analog integrated circuits. An expanded

program of research on reliability of semiconductors and on semiconductor circuit radiation hardness will complement research on improved semiconductor materials properties. The manufacturing sciences research program initiated in FY 1982 will integrate basic research in automation science, non-destructive inspection sensors, control theory, materials processing, and artificial intelligence. This research enhances the possibility of flexible robotic assembly of aerospace systems.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

14. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2307, Fluid Mechanics

A. (U) Project Description: Fluid mechanics research provides knowledge essential for improving the efficiency and effectiveness of Air Force flight vehicles. In order to achieve this goal, research is conducted to provide physical understanding of key flow phenomena, to devise improved theoretical models based on that understanding, and to originate concepts which will expand current aerodynamic performance boundaries. Future directions in aircraft performance requirements will include better fuel efficiency, capability to operate from shortened or damaged runways, and capability to maneuver in the post-stall flight regime. These technology needs indicate research directions to better understand aerodynamic drag generation in turbulent flows, the characteristics of jet-interacting flow fields, convective heat transfer in gas turbines, and the characteristics of time dependent, three-dimensional separated flow. The results of this research will provide the background necessary to assure the design and production of superior flight vehicle weapons systems.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Reductions in aerodynamic surface friction drag of 8 to 30 percent have been demonstrated using arrays of thin blades inserted into the boundary layer region above and parallel to the surface. Although the blades generate profile drag, the reduction in turbulence induced surface shear stress is far greater and persists for a long distance downstream yielding a net decrease in overall friction drag. Approximately 50 percent of the total drag of a cargo plane is due to skin friction. For a cargo plane such as the C-5, a 20 percent reduction in friction drag would result in a 10 percent reduction in total drag which would save 13 million gallons of fuel per aircraft over 20 years. (2) The control of separated flow using a computer-controlled oscillating flap has been demonstrated. The flow reattachment lengths were reduced up to 30 percent of the natural steady flow case. Uncontrolled flow separation causes serious degradation in aircraft performance, particularly for fighters under maneuver conditions. Active separation control has promise for improving fighter agility beyond the limits of conventional steady aerodynamics. (3) Aerodynamic sweep theory has been successfully applied to axial flow engine compressor blades to reduce flow losses. When the theory was used to modify the blade shape for a high performance

research compressor, an efficiency improvement of three percent was realized. This improvement can be directly translated into a three percent reduction in fuel consumption or a three percent increase in range.

(2) (U) FY 1985 Program: Generalized grid generation procedures, adaptive grids based on error analysis, and algorithms suitable for vector processors are being investigated to increase computational speed and accuracy for the simulation of three-dimensional solutions of the Euler and Navier-Stokes equations. Computational fluid dynamics methods are also being used to simulate the evolution of turbulence structure in boundary layers and to study the interactions of impinging turbulent jets. Improved prediction methods are sought for strongly separated flows with particular emphasis on more accurate turbulence models and on the capture of regions of vortical flow. Investigations of the onset, evolution, and dynamical significance of organized, deterministic structures in turublent shear layer flows will continue with increased emphasis on theoretical modeling. New mechanisms for passive, active, and interactive control of turbulent flows will be explored. Emphasis in internal fluid dynamics will focus on identifying and quantifying losses associated with three-dimensional flow interactions in rotating machinery, and clarifying the mechanism of rotating stall. More accurate and detailed heat transfer information is sought in highly curved internal flow passages with and without film cooling.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: A new initiative will focus on unsteady aerodynamic phenomena which can lead to significant improvements in flight vehicle maneuverability. The combat effectiveness and survivability of a fighter aircraft which can execute dynamic, post-stall maneuvers to increase its pointing speed and expand its firing window has been estimated at 50-300 percent greater than that of a conventional aircraft. Research in this initiative will investigate unusual flow separation phenomena responsible for extremely high lift levels when wings undergo rapid, large amplitude motions. Schemes for productively exploiting these effects to achieve vehicle control and optimized performance during the large velocity excursions typical of post-stall maneuvers will be pursued. The capability for real-time active control of isolated separation vortices will be sought. In other areas of continued emphasis, the turbulence program will maintain its focus on deterministic structure and mechanisms through a broad-based program of experiments, analysis, and computations. The significance of interactive turbulence control in providing a new view of shear layer behavior will also be investigated. Effort will continue in computational fluid dynamics to improve numerical speed and accuracy for steady and unsteady flow past complex three-dimensional shapes in compressible flow.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

15. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2308, Energy Conversion

A. (U) Project Description: This project is concerned with reacting flows, combustion, and energy conversion in propulsion and power systems. It includes both airbreathing combustion and non-airbreathing chemical rockets, as well as propulsion systems using electrical nuclear power, laser or solar energy sources. New knowledge is sought for the use of advanced liquid, slurry, and solid chemical propellants for improved performance and safety. Technology needs include reduced exhaust signature, control of combustion instabilities, reductions in maintenance costs, and improved durability. New diagnostic measurement capability is needed for both laboratory research and on-board control. The goal is to reduce the cost and to increase the flexibility, durability, and performance of future Air Force systems.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Chemical additives of alkaline halides have demonstrated a 50 percent reduction in soot volume fraction in a laboratory premixed flame. Such technology is critical to reducing detectable aircraft exhaust signatures. A systematic investigation of additive chemistry will provide the means to determine additive effectiveness on gas turbine hot section durability and exhaust signature reduction. (2) A major factor inhibiting the use of ramjet propulsion for very high speed flight is instabilities which can result in vibrations which destroy the airframe or guidance system. Experiments in a model ramjet combustor have quantified the relationship among combustion chemistry, cavity acoustics, and fluid mechanics which produce combustion instability. From this investigation, design and dynamic control methods can be developed to eliminate ramjet and rocket instabilities. (3) Laser-sustained plasmas have been produced under high pressures at temperatures in excess of 15,000K. Plasmas offer the potential for 70-100 percent increase in thruster efficiencies with an attendant 60-70 percent improvement in the ratio of payload to total vehicle mass in rockets over present systems. (4) Rapid wavelength-modulation spectroscopy provides the capability to make in-situ nonintrusive laser measurements in a combustion experiment of chemical species and temperature at a measurement rate of 4KHz. This rate represents a three order of magnitude improvement over previous capability and offers the potential for real-time temperature monitoring in combustion flows. This will allow real-time monitoring of combustion processes in propulsion systems necessary for control.

(2) (U) FY 1985 Program: An FY 1985 initiative in jet engine hot section research pursues the knowledge for substantially higher performance, more reliable jet engines. Major emphasis is being placed on prediction of turbulent reacting flows, chemistry and fluid mechanics of liquid and metal slurry spray combustion, durable ceramic-composite materials, and carbon-carbon material. The initiative begun in FY 1983 in space propulsion addresses the scientific issues underlying future space systems requirements including power beaming, plasma interactions, thermal management technology, and more energetic propellants. Research directed at diagnostic methods applicable to laboratory scale reacting flows is leading to research on novel sensors, real time optical processing, and dynamic combustion control strategies for adaptive control and autonomous operation of propulsion systems. The dynamics of high-speed turbulent

and transient chemically reacting flows are being investigated. Research on heat effects and oxidation kinetics of hydrocarbons is continuing with emphasis on aromatic hydrocarbon constituents of future fuels. Research is being conducted on radiative and catalytic means of ignition and flame holding for airbreathing engines. There are increases in efforts pertaining to the combustion of alternative fuels and high-energy/high density fuels such as carbon and boron slurries, ramjet combustion instability, and supersonic and dual mode (subsonic and supersonic) combustion. Efforts are continuing on particulate and soot formation and other combustion generated exhaust emissions. Research is underway to control the processes required to efficiently burn metals. The potential of realizing improved propellants through additional research on new energetic binders is being addressed. Emphasis is being placed on nonconventional propulsion for orbit raising of large payloads. Research on electrode erosion and plasma stability will increase the power levels and efficiencies of continuous operation magnetoplasmadynamic thrusters. Research on the initiation, thermal isolation, and stability of laser sustained plasmas addresses the performance limits of beamed energy propulsion and power.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1985 initiative in jet engine hot section research will continue with emphasis on turbulent flow characterization, chemical kinetics, and non-metallic materials. The initiative begun in FY 1983 in space propulsion will have established the initial efforts in innovative thermal management techniques, nonchemical propulsion, and ultra-high power density energy conversion. This will provide the necessary knowledge to obtain the fourfold increases in orbit-raising propulsion efficiency needed for the large communications, surveillance, and weapons satellites of the 1990's and beyond. Attention will be given to advanced diagnostics for performing research on energetic materials, particularly rapid condensed phase processes. Research will continue on new techniques which are essential in understanding combustion systems, airbreathing and rocket engines, and effective fuel use. Continuing research will be directed at the dynamics of high-speed turbulent steady-state flows and transient chemically reacting flows with emphasis placed on realistic modeling and characterization of the flow field, processes, and phenomena occurring in dump-type ramjet, gas turbine, and ducted rocket combustors. The national research effort directed at the combustion of high density fuels for ramjets and ramrockets will be assessed so as to identify the potential for rapid ignition and low pressure combustion. Attention will be given to establishing the research needs associated with ramjet combustion instability and supersonic/dual mode combustion. Physical and chemical reactions in exhaust plumes along with a number of radiation phenomena will be studied. Efforts relating to rocket combustion dynamics will continue to be emphasized with the long range goal of making assessments of the likelihood of stable motor operation. These studies will lead to higher performance, more reliable, less detectable rocket motors.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

16. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2309, Terrestrial Sciences

A. (U) Project Description: This project provides basic research in geodesy, gravity, and seismology to understand the problems associated with increasing missile accuracy. Research in geodesy is required to determine the exact position of targets with respect to missile launch sites. Research in gravity is required to determine its effect on missile guidance systems along flight paths. Research in seismology is required to determine the effects of earthquakes, nuclear explosions, and other natural or system-generated noise on the degradation of missile guidance systems before launch as well as on other Air Force Systems and facilities.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Seismic wave propagation and source characteristics were studied using data from high explosive detonations. These studies permit the prediction of strong ground motion in complex structures and the effects on Air Force facilities. This work can lead to techniques for extrapolating the source characteristics of underground nuclear explosions to surface tests. (2) A study was made of the slowly time varying ground tilt in seismically active areas to investigate the characteristics of earth deformation in a small, active seismic zone. Such investigations support improvements in targeting of strategic weapon systems and weapon delivery by leading to techniques to predict the effects of tilt on the stability and vulnerability of missile systems. (3) Precise geodetic measurements were made using the Global Positioning System (GPS) with microprocesso controlled real time solutions of the radio interferometric equations. This work could lead to the determination of highly accurate satellite orbits for Air Force space missions and to the more accurate measurement of azimuth, latitude, and longitude for missile guidance initialization.

(2) (U) FY 1985 Program: The potential of Very Long Baseline Interferometry (VLBI) observations to monitor crustal motions is being examined. Theoretical and numerical techniques are being developed to handle seismic propagation problems in complex media for application to field recordings of ground motion from earthquakes and from underground and atmospheric explosions. Seismic wave generation and propagation in regions of the United States similar to the Soviet Union are being studied to estimate the effects of strong ground motion. Calculations and field measurements of the seismic structure are being carried out for proposed missile sites near Cheyenne, Wyoming. Recordings of local explosions and earthquakes are being analyzed to quantify relative effects of seismic explosion source functions and effects of nonlinear properties along propagation paths. Small-scale laboratory chemical explosions are being used to scale source and propagation path effects to design and field large chemical explosions to study nuclear effects. To design more effective protective structures, spall associated with near surface ground motions generated by nuclear blasts over valley structures selected for missile sites is being studied. Spall mechanisms will be identified and related to weapon yield, height of burst, depth of burial, and material properties.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continuing analysis will be made of Very Long Baseline Interferometry (VLBI) and Lunar Laser Ranging data to determine variations in the earth's rotation rate. Several dual frequency Miniature Interferometric Terminal for Earth Surveying (MITES) terminals will be completed. The MITES system will be evaluated as a monitor of earth movement and deformation. MITES technology will be used to improve satellite orbit determination. Satellite interferometry data will be examined to determine earth movement and deformation. Worldwide tidal gravity measurements will link data from different continents to yield improved earth tide models. The use of satellite altimetry data will emphasize the creation of a preliminary geoid from Geodetic Satellite (GEOSAT) observations. A spherical harmonic solution based on a best linear prediction approach will allow a detailed description of the Earth's gravity field from GEOSAT measurements. Field recording of seismic waves from surface and underground explosions will be used to study wave propagation in three-dimensional structures. Emphasis will be placed on understanding strong ground motion at distances of five to fifty kilometers from the source. Seismic wave excitation and propagation will be studied at regional and teleseismic distances to obtain source and earth structure parameters. Methods for predicting ground motion from distant earthquakes based on source and propagation modeling will be investigated. Computer algorithms and models will be formulated to understand and to explain the propagation, attenuation, focusing, and phase conversions of seismic energy through complex geological structures at missile sites, including cratering dynamics. Data from mid-Pacific hydrophones will be used to determine the propagation of seismic phases from nuclear explosions and earthquakes. Data from infrasonic arrays will be investigated to study the propagation of acoustic energy from nuclear explosions and earthquakes.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

17. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2310, Atmospheric Sciences

A. (U) Project Description: The research program in atmospheric sciences focuses on the most significant variables of the earth environment from the earth's surface to satellite altitudes. Air Force systems must take into account adverse impacts of atmospheric properties such as density, optical transmission, wind, temperature, precipitation, and infrared emissions. Particular attention is aimed at properties affecting optical and infrared weapons systems and weather prediction. Analyses of upper atmosphere variability and ionosphere dynamics are major research efforts to enhance communications and surveillance systems capability. Both depend upon ionospheric behavior and variability.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: (1) The existence of a particular mechanism producing infrared (IR) background radiation in the upper atmosphere has been confirmed. Laboratory measurements of collisions between oxygen atoms and oxygen molecules show that energy is released as IR radiation in the eight to eleven micron atmospheric window. With this result, naturally occurring IR backgrounds can be more reliably predicted, setting the sensitivity thresholds for surveillance and targeting systems. (2) For the first time, incoherent-scatter ionospheric measurements were obtained simultaneously at three widely spaced locations in the auroral oval. These data provided experimental evidence of large nighttime ion densities over Scandinavia and the Soviet Union which do not appear over North America. These measurements show that the important factor is the offset between the geographic and geomagnetic north poles which leads to electron transport from the opposite dayside by convective magnetic fields. This knowledge is important in predicting successful performance of northward facing over-the-horizon (OTH) communications and surveillance systems. (3) A general theory was devised for solving plasma wave problems. This is a major breakthrough in plasma physics. The newly derived analytic solution to the fundamental Landau damping formula now allows its application to collisional versus collisionless plasmas. This result opens up a whole new area of space and laboratory plasma research, and sets the stage for modeling energy inputs onto the auroral zone and prediction of time varying characteristics of background radiation that ground-based and space-based surveillance systems must take into account to be effective.

(2) (U) FY 1985 Program: Battlefield-scale weather investigations will begin off the east coast in a major field program cooperatively supported with the National Science Foundation. New understanding of mesoscale weather interaction will allow improved Air Force operational forecasts. Irregularities in ionospheric structure will be studied in rocket experiments over Greenland. New knowledge of the structure, dynamics, and detailed composition can lead to increased effectiveness of severe radio signal fluctuations in Very High Frequency (VHF) and Ultra High Frequency (UHF) communications systems. Initial experiments will begin in a recently completed cloud simulation chamber. Increased understanding of cloud droplet formation and particle scavenging will help improve cloud prediction capabilities for Air Force systems. Research continues toward establishing the effects of large mountain ranges and plateaus on the initiation and development of weather events. Synoptic analysis of at least three cases of precipitation development over the Tibetan Plateau and the United States Great Basin are in progress. Subsequent boundary layer parameterization may lead to predictive mesoscale models dramatically improving battlefield scale forecasting skill. Air Force systems requiring infrared (IR) transmission for guidance or communication must operate in a wide variety of climatic regimes including path lengths beyond 25 km. Research continues toward understanding the effects of water vapor and other atmospheric constituents on long range IR transmission up to 44 km. Improved transmittance models will permit better design of electro-optical systems, increased understanding of atmospheric limitations on their performance, and ways to maximize their effectiveness.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Investigations into the middle atmosphere will explore high altitude (80-100 km) wave-like structures which contribute to a changing infrared (IR) background scene. Information on causes, conditions, and wave propagation will increase understanding of possible impacts on IR surveillance and targeting systems. A series of field experiments will be conducted to assess the

potential impact of ionospheric irregularities on offensive and defensive systems. Continuing research using the new computer-controlled cloud simulation chamber will expand in a Tri-Service support effort to investigate ice formation in clouds, and optical and infrared transmission. Major emphasis will continue to be placed on mesoscale meteorology and ionospheric physics. The mesoscale research program is focused on the separation and quantification of nonlinear processes having a significant impact on medium scale weather processes. These include atmospheric heat and moisture fluxes near the surface of the earth and the role of gravity waves and convective clouds in the evolution of atmospheric mean flow. Using these processes in predictive models will improve the ability to provide accurate weather support for Air Force operations worldwide. In ionospheric research, the new National Science Foundation-sponsored radar at Sondrestrom, Greenland, will be used with other sensors to understand and model the role of the ionospheric polar caps on the behavior of the global ionosphere and its impact on Air Force systems such as the Global Positioning System (GPS) and the Over-The-Horizon (OTH) radar.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

18. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2311, Astronomy and Astrophysics

A. (U) Project Description: This project provides basic knowledge of the space environment for the design and calibration of advanced Air Force systems. The project also supports the Air Weather Service by improving observing and forecasting techniques that support operational military systems. Space environmental conditions produced by radiation and charged atomic particles can endanger the mission and degrade the performance of military spacecraft, disrupt the detection and tracking of missiles and satellites, distort communications, and interfere with surveillance operations. Experimental and theoretical means are used to study methods to improve space surveillance systems and to study solar outbursts and their travel to the earth where they affect communications and satellite systems. Also being studied are the composition of the space environment in which Air Force systems operate, changes caused by natural and man-made disturbances, and the response of spacecraft systems and operations to the space environment.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) A technique has been devised to predict the arrival time at the Earth of shock waves caused by solar flares. The travel time of the shock wave from the sun to the earth can vary from minutes to hours depending on the solar flare energy and can be predicted with an accuracy of about 20 percent. This technique requires data on solar radio waves and the solar wind speed. Such solar disturbances can modify the near-Earth space environment and can pose hazards for manned and unmanned space missions. (2) A study has been made of the thermal electrons and ions in the topside ionosphere environment. This study compared radar and satellite auroral data and used this data to define the form of the equatorial ionospheric irregularities. Software has been created for

use by the Air Force Global Weather Center for the real-time processing of sensor data. (3) A coordinated study using ground based and Solar Maximum Mission satellite observations has been made of solar flares, whose radiation and charged particles can disrupt Air Force communication and detection systems and endanger spacecraft and astronauts. Specific items included energy transport mechanisms, radiation losses, and the timing relationship between X-ray generation and solar chromospheric response. These studies will be used to predict the effects of solar disturbances on Air Force space missions.

(2) (U) FY 1985 Program: Solar emissions that influence the aerospace environment are being described and used to provide forecasts of dangerous radiation hazards for man-in-space and to improve forecasts of communication disruptions in polar regions. Radio emissions in solar flares are being examined to extend the warning time and accuracy of solar particle events. Aspects of particle precipitation in the quiescent and disturbed magnetosphere are being modeled and the access of cosmic ray particles to high satellite latitudes and various altitudes are being studied to predict and specify the energetic particle radiation environment for spacecraft. Instrumentation for Shuttle flights is being pursued to study ambient electric and magnetic fields together with plasma and energetic particle data, and wave-particle interactions in order to determine magnetosphere/ionosphere energy transfer and to derive from direct measurements the characteristics of Space Shuttle environmental electromagnetic interference. Irregularities in the ionosphere which adversely affect communications in the near-Earth space environment are being studied. Techniques for observing and imaging space objects using large, ground-based telescopes are being studied for advanced surveillance and reconnaissance imaging systems. Studies are being made to define spectral, spatial, and temporal signatures of the celestial infrared background to permit development of effective techniques for target discrimination and tracking.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Research will be performed to improve the accuracy and reliability of predictors of solar proton time intensity profiles. Studies of specific solar-terrestrial events will be continued in an effort to delineate unique solar-interplanetary/terrestrial characteristics that would be useful as predictors. The reduction of interplanetary scintillation data to attempt real-time warning of approaching solar-wind disturbances will be automated. Space-borne white-light photometer techniques for studying the propagation of solar mass ejections toward the Earth will be studied. Fine-scale magnetic field configurations, flux levels, and evolutionary changes which occur in active solar regions prior to solar flares will be identified. Solar oscillations will be measured and classified to determine the internal structure of the Sun. Diode array detectors will be used to obtain solar images on millisecond time scales allowing the rapid changes associated with solar flares to be detected. A dedicated solar speckle imaging facility, using a charge coupled device (CCD) detector, will be used to obtain near real-time sequences of high-resolution images of small scale solar features, free from the distorting effects of the earth's atmosphere. Solar bursts and regions of solar activity will be studied using observations at radio wavelengths taken at large radio telescope arrays. Correlations will be made between solar radio emissions, gamma-rays, and interplanetary particles to determine the observable characteristics of proton acceleration in flares. The precipitating electron data acquired from satellites will be analyzed in an effort to better understand and describe the energetic particle population precipitating into the aurora. The accessibility of charged particles to various satellite orbits will be studied. The dynamics of ionospheric plasma instabilities

associated with the break up phase of auroral substorms will be analyzed. A major extension of the computer code to include the magnetotail region will be performed, thus laying the foundation for a predictive, global substorm model. Research to predict the energetic solar flare particle flux to spacecraft at various latitudes will be initiated. Algorithms to compute the cosmic ray exposure to spacecraft orbiting at various low altitudes will be investigated.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

19. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project 2312, Biological and Medical Sciences

A. (U) Project Description: This research program provides knowledge needed to protect Air Force personnel and enable them to perform effectively in hostile environments. The biological effects of electromagnetic radiation and toxic chemicals are being studied to assess hazards to personnel and the environment and to devise protective measures. Research in neurobiology is being conducted to understand the biological bases of human performance and provide ways of reducing the effects of fatigue, jet-lag, and diurnal rhythms. Research to develop computer architectures modeled after neuronal systems is aimed at providing powerful new approaches to machine intelligence.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Certain amino acids, such as tyrosine, contained in foods that are part of normal diet, have been shown to modulate the effectiveness of certain neurotransmitters. The ratio of tyrosine to other dietary components determines the amount of the neurotransmitter serotonin released from nerve endings. Because serotonin is involved in several behavioral functions, this finding suggests the possibility of using temporary modification of diet to aid human performance under prolonged stress. This work will be continued by studying behavorial effects of modifying diet. (2) Research on the mechanisms of action of toxic chemicals used by the Air Force has led to the significant discovery that benzamide compounds can be used to prevent cancer in cells exposed to cancer-causing chemicals. The mechanism by which those compounds produce their anti-cancer effects is believed to involve the maintenance of a structural sugar-protein scaffolding that surrounds the genetic material in cells. This scaffold is typically degraded by carcinogens. This suggests the possibility of using a drug to protect individuals from the carcinogenic effects of toxic chemicals or radiation. This work will continue by examining the extent to which benzamides may protect from radiation induced cancer.

(2) (U) FY 1985 Program: Research on electromagnetic radiation is directed at determining the molecular mechanisms by which nonionizing radiation affects living cells. Particular attention is given to understanding the nature of harmful effects that cannot be attributed to simple heating of cells. New studies of the effects of pulsed, millimeter wavelength microwaves are being initiated. Research in toxicology is directed toward the kinds of chemicals

to which Air Force personnel may be exposed. Studies of how toxic chemicals enter the body, where they act, and how the body responds provide a basis for predicting long-term health hazards and setting rational standards for limiting exposure. FY 1985 initiative funds will establish a solid program of research in the regulation of neuronal responsiveness. This research includes studies of the molecular and cellular mechanisms that determine the pattern of neuronal response to synaptic inputs and the moment-to-moment tuning of neuronal circuits. A small effort to model computer architecture on neurobiological principles continues.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Research on biological effects of electromagnetic radiation will continue with larger emphasis on the design of probes to monitor the molecular events affected within living cells. Sources of exposure of personnel to radio frequency radiation are rapidly expanding and include new wavelengths and modes of modulation. Thus, the study of the molecular and cellular mechanism by which electromagnetic radiation damages living organisms is essential to the development of rational standards with which to protect personnel from radiation exposure. Toxicological research will be expanded to include studies to improve understanding and control of the impact on ecological systems of chemicals released into the environment during Air Force operations. The relation of chemical structure to mode of toxic action, tho body's mechanisms of detoxification, and the possibility of developing early biochemical indicators of long-term toxic effects will be investigated. The level of effort in neurobiological research will reach full program size and stabilize. The objective of this program is to understand the cellular and molecular mechanisms of neuronal activity that determine the state of responsiveness of the intact organism. This knowledge should provide a basis for attempts to improve human performance and to reduce the negative effects of stress, fatique, and disruption of sleep-wake cycles.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

20. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2313, Human Resources

A. (U) Project Description: This program provides the knowledge required to ensure that Air Force personnel can operate, maintain, and manage complex equipment systems in demanding environments. The major objectives are to select personnel for appropriate jobs on the basis of measured mental abilities and sensory-motor skills, to design equipment to match human information processing characteristics optimally, and to monitor human workload and performance.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (1) Research on the mechanisms with which humans shift their visual attention from moment to moment among objects and events is showing significant implications for Air Force operations. It appears that attention works like a shutter gate, producing sequential snapshots of visual events with an exposure

duration of about 150 milliseconds. During this exposure period, individuals cannot distinguish the relative sequence or place of events. One implication of this finding is that equipment displaying rapidly changing situations such as aircraft instrument panels, command and control situation boards, and air traffic control displays should be designed to prevent confusion between events occurring in close sequence. (2) A sophisticated computer-based system for administering ability tests to large numbers of subjects has been devised. This system allows investigation of the components of mental skills in ways not possible with conventional pencil and paper tests. For example, preliminary data suggest the need to reinvestigate traditional assumptions that the speed with which an individual learns a mental task and the ultimate mastery of that task are closely related.

(2) (U) FY 1985 Program: The program in vision research is directed toward formulating a quantitative description of how the human visual system processes and extracts information. A small amount of research is being started to investigate the mechanisms by which the auditory system recognizes and analyzes complex sounds. The biocybernetics/workload program supports research in which noninvasive techniques are used to monitor the brain activity of individuals as they perform various tasks. This may provide ways of monitoring the workload and performance of individuals in actual work situations. Research on learning abilities is directed toward determining the cognitive components that underlie the ability to perform various kinds of work tasks. This research should lead to improved methods of testing and selecting individuals for appropriate Air Force jobs.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: A major FY 1986 initiative is planned in the area of auditory pattern recognition. This program will extend the current efforts in sensory information processing and will emphasize studies to determine how humans localize sound, recognize complex sounds in the presence of noise and distortion and analyze auditory information in performance tasks. The program in vision research will continue at its present size and will continue to extrapolate results from controlled laboratory tasks to the complex and dynamic environment of Air Force operations. This is expected to provide a much improved basis for assessing and training the visual skills of pilots and setting standards for selection of individuals for flight programs. The techniques used to follow massed electrical and magnetic activity of the brain will be compared to other behavioral and neurobiological research approaches in the biocybernetics program.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

21. (U) PROJECT IS $10 MILLION IN FY 1986:

(U) Project: 2917, University Research Instrumentation

A. (U) Project Description: An Interagency Working Group on University Research Instrumentation concluded that the deterioration of research facilities at universities in the United States has reached a crisis stage. In order to restore the university research base in areas supporting DOD objectives, the Office of the Secretary of Defense

directed that each Service increase its research budget request by $10 million starting in FY 1983. For comparison, the Air Force research program normally provides $3 million to $8 million per year for research equipment. The Air Force plans to fund equipment purchases associated with scientific research directed to the advancement of military aerospace technology. This project was initiated to manage the resources.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The program was advertised in the summer of 1983. All equipment proposals were submitted to the Air Force Office of Scientific Research as the central point for administrative control for all three Services. The Air Force Office of Scientific Research administered the Air Force portion of the program by selecting research equipment proposals for funding based upon the significance to the Air Force and scientific merit of the related research, competence of the research personnel, reasonableness of the proposal cost, and value to the Air Force of the increased research capability resulting from the proposed research equipment purchases.

(2) (U) FY 1985 Program: The program is continuing in FY 1985 with the Air Force Office of Scientific Research again acting as the central point for administrative control for all three Services.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Present guidance from the Office of the Secretary of Defense is to continue this project at the funding level of $10 million in FY 1986. The Army Research Office will act as the central point for administrative control for all three Services.

(4) (U) Program to Completion: Present guidance is to continue this project at the funding level of $10 million per year through FY 1987.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61103F
DOD Mission Area: #510 - Defense Research

Title: University Research Initiative
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	6,250	12,500	25,000	43,750

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED. There is a critical need to fund instrumentation programs, graduate fellowships, research assistantships, and research initiatives in emerging technological areas critical to the Air Force. This program element will address Air Force interests regarding expanded support for university research in areas critical to defense.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable. New start.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Similar programs are to be started by the Army, Navy, and the Defense Advanced Research Projects Agency (DARPA). Complements support for university instrumentation programs provided under PE 61102F.

6. (U) WORK PERFORMED BY: Universities.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 61103F, University Research Initiative

A. (U) Project Description: The purpose of this program is to provide funding for instrumentation programs, graduate fellowships, research assistantships, and research initiatives at U.S. universities in scientific areas of critical interest to the Air Force.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable. New Start.

(2) (U) FY 1985 Program: Not Applicable. New start.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Fund university instrumentation programs, graduate fellowships, and research assistantships in scientific areas of critical interest to the Air Force such as materials and structures, biotechnology, fluid mechanics, mathematics and statistics, electronics, propulsion, physical and chemical sciences, and cognitive sciences. Initiate a research program with universities that addresses scientific areas of critical interest to the Air Force. The program will be structured to fund emerging technical initiatives in basic research.

(4) (U) Program to Completion: The stated FY 1986 program will continue through FY 1988. In FY 1987 and FY 1988, funding will also be provided to start academic research efforts in the innovative technology areas noted above.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62101F
DOD Mission Area: #522 - Environmental and Life Sciences (ED)

Title: Geophysics
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985** Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		41,347	37,086	38,614	42,481	Continuing	N/A
06GL	Laboratory Operations	22,031	22,668	22,964	24,245		
3054 *	Infrared Target and Background Signatures	0	1,829	2,098	3,543		
4643	Ionospheric Specification	2,180	2,457	2,136	2,323		
6670	Atmospheric Science and Technology	1,627	1,610	1,659	1,781		
6687	Middle Atmosphere Effects	794					
6690	Upper Atmosphere Technology	1,524					
7600	Terrestrial Geophysics	955	1,135	926	991		
7601	Magnetospheric Effects on Space Systems	1,980	2,325	4,651	5,135		
7659	Aerospace Probe Technology	972	1,141	684	729		
7661	Spacecraft Environment Technology	2,128	2,056	COMBINED WITH PROJECT 7601			
7670	Optical/Infrared Properties of the Environment	7,156	1,865	3,496	3,734		

* Separate project formed from task under Project 7670
** Excludes January 1985 Civilian Pay Raise (732)

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The geophysical environment has the capacity to alter the performance of Air Force systems and operations. Functions significantly affected by geophysical conditions, and which can be nullified completely by them, are missile guidance, air launch and recovery, space vehicle tracking, satellite surveillance and communications. This science and technology program element provides the technology to understand the environment as an integral and interacting part of the systems themselves and enables Air Force systems planners and users to mitigate environmental effects, and in some cases, to exploit them. It also provides for the management and support of the Air Force Geophysics Laboratory, Hanscom AFB, MA.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	40,037	37,116	40,456			

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Military Construction: Funds	2,250	0	0	0	0	2,250

5. (U) RELATED ACTIVITIES: This program greatly benefits from research in Program Element (PE) 61102F, Defense Research Sciences. Major beneficiaries of the technology developed in this program are PE 63410F, Space Systems Environmental Interactions Technology; PE 63424F, Missile Surveillance Technology; PE 63438F, Satellite Systems Survivability; PE 63707F, Weather Systems (Advanced Development); PE 63403F, Continental United States Over-The-Horizon Backscatter Radar System; PE 64707F, Weather Systems (Engineering Development); PE 63402F, Space Test Program; PE 63435F, Integrated Operational Nuclear Detection System; PE 12431F, Defense Support Program; PE 35111F, Weather Service; and PE 35160F, Defense Meteorological Satellite Program. Programs in the broad area of geophysics are conducted by the Army and Navy and non-military federal agencies such as the National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration. When applicable to Air Force requirements, information gathered by others is used in the Air Force program. In addition to such complementary programs, joint or coordinated programs are conducted with other agencies when mutual interests exist. The work within this program element is coordinated (1) at the annual tri-service briefings to the Office of the Under Secretary of Defense for Research and Engineering during the Science and Technology Program review, (2) through the National Aeronautics and Space Administration/Air Force Systems Command Space Technology Interdependency Working Group which meets semiannually, (3) with National Oceanic and Atmospheric Administration and other federal agencies engaged in geophysical sciences through committees of the Federal Coordinating Council for Science, Engineering, and Technology and the Federal Coordinator for Meteorological Services and Supporting Research, and (4) through working groups set up by the Air Force Geophysics Laboratory, such as the Meteorological Satellite (METSAT) Tech Exchange Working Group. Examples of joint or coordinated programs are: Spacecraft Environmental Interactions, a joint program with the National Aeronautics and Space Administration to develop environmental specifications for future large space structures; Atmospheric Transmission, a coordinated program with the Army and Navy to develop the capability and the computer codes to predict and overcome the obscuring effect of the atmosphere on visual, infrared and millimeter wave sensors employed in tactical and strategic systems; Intercontinental Ballistic Missile Accuracy, a coordinated program with the Defense Mapping Agency to develop techniques and geophysical instrumentation to improve intercontinental ballistic missile targeting accuracy; and Nuclear Weapons Effects, a program with the Defense Nuclear Agency to model the nuclear-disturbed environment.

6. (U) WORK PERFORMED BY: Work performed under this program is conducted and managed by the Air Force Geophysics Laboratory, Hanscom AFB, MA. Off-base field sites are: Weather Radar Site, Maynard, MA; Weather Test Facility, Otis AFB, MA; Goose Bay Ionospheric Observatory, Goose Bay, Labrador; and Balloon Launch Detachment, Holloman AFB, NM. Five of the major contractors were: Utah State University, Logan, UT (Project 3054), Boston College, Chestnut Hill, MA (Project 4643), Northeastern University, Boston, MA (Project 7659), University of Toronto, Toronto, Ontario (Project 7601), Systems and Applied Sciences, Vienna, VA (Project 6670). In addition, there were approximately 73 other contractors doing work under contacts totaling $12.8 Million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3054, Infrared Target and Background Signatures. The objectives of this project are to characterize the infrared signatures of both natural and nuclear earth/atmospheric backgrounds and military targets-of-interest which operate therein. Infrared backgrounds and targets are characterized through the use of field data obtained using rockets, aircraft, balloons and the space shuttle as measurement platforms. These data are analyzed, compared against theoretical and laboratory measurements, and then integrated into models for infrared surveillance systems application (design, development and operations). During FY 1984, this work was within Project 7670. In FY 1985, high spectral resolution rocket-borne measurements will be obtained of a strong aurora using two rocket payloads. The Spectral Infrared Interferometer Telescoped (SPIRIT) payload will acquire auroral data in a limb-viewing geometry; the High Resolution Auroral Measurements (HIRAM) payload will acquire short wave length infrared auroral data in an up-looking geometry. In addition, the major Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) payload will be completed, tested and delivered to the integrating contractor. In FY 1986 work will commence on the design, development and fabrication of the rocket-borne Electron Seeding Experiment (EXCEDE III) which will simulate effects of a nuclear event using a very high current electron gun, the signature of which will be measured with an instrument on a daughter payload. Testing of the Fourier Interferometer for Random Source Transients (FIRST), an interferometer spectrometer designed to measure pulsed infrared targets, will be conducted using lightning as a source. Airborne measurements of classified targets will continue as a follow-on to the FY 1985 ground truth measurements conducted in support of the Defense Advanced Research Projects Agency/Space Division (DARPA/SD) Teal Ruby Program.

B. (U) Project: 4643, Ionospheric Specification. The general objective of this project is to develop the capability to predict, mitigate and exploit the effects of the ionosphere on AF systems. Specific efforts include: (1) Measuring the effect of D Region conductivity on Extra Low Frequency/Very Low Frequency (ELF/VLF) radio propagation; (2) Specifying and predicting polar cap ionospheric irregularities that disturb high latitude communications and radars; (3) Developing techniques to predict ionospheric characteristics that affect the performance of the Over-The-Horizon radar; (4) Developing instrumentation and techniques for Defense Meterological Satellite Program (DMSP) to remotely measure the ionospheric electron density on a global basis; (5) Showing feasibility of using ultraviolet (UV) technology for missile detection and tracking; (6) Exploring the feasibility of creating ionospheric disturbances. In FY 1984, the Airborne Ionospheric Observatory began making measurements of wide-band radio transmissions from a polar orbiting Defense Nuclear Agency satellite, to improve the scintillations and total electron content data base used to forecast the effects of ionospheric irregularities. The Airborne Ionospheric Observatory made measurements during the

mid-latitude chemical release experiment which was designed to induce a controlled perturbation in the ionosphere. These measurements will aid the development of a capability either to produce or mitigate an ionospheric disturbance, as desired. In FY 1985, a major field program will be conducted from Greenland to study the formation of polar cap F-region irregularities and their effect on transionospheric radio propagation. Within the ultraviolet (UV) technology area, a UV spectrometer will be delivered and integrated for flight on board the shuttle. The feasibility study on remote sensing of electron densities will be delivered to Space Division (SD/DMSP). In FY 1986, extensive use will be made of the KC-135 flying ionospheric laboratory to support the testing of the Over-The-Horizon (OTH) East Coast Radar System. The relationship between optical emissions and electron density profiles will be determined and correlated with the UV airglow measurements from Polar Bear Satellite in order to develop a more real time capability for obtaining global electron density maps. These maps support High Frequency Communications, OTH and Spacetrack Radar. UV target and background measurements will continue in order to establish a data base.

C. (U) Project: 6670, Atmospheric Science & Technology. This project develops techniques and instrumentation for measuring, modeling and predicting atmospheric properties which impact the Air Force mission. The atmosphere is global in extent and requires global measurement systems and computer modeling capability. Air Force applications, however, are primarily regional in domain. Thus, a scale hierarchy of measurement and modelling capability is being developed under this project to provide the framework for the smaller-scale models having direct Air Force applications. In FY 1984, using the satellite image processing system, several techniques were developed to evaluate the automatic cloud analysis algorithms which are used operationally at the Air Force Global Weather Central. A planetary boundary layer capability for the global forecast model used by the Air Force Global Weather Central in support of strategic and tactical reconnaissance and strike missions was developed and tested. The relationships between the Digital European Backbone line-of-sight radio outages and meteorological conditions were established. In FY 1985 doppler and conventional radar data will be incorporated into local area forecast studies. Testing will be completed of interactive forecast techniques for use in the Automated Weather Distribution System under development for the Air Weather Service. The assessment of active satellite techniques for vertical sounding of atmospheric parameters, such as temperature, water vapor, and cloud heights and thickness, will continue. In FY 1986, the results of analyses of ground based, rocket and satellite data will be combined to generate the Air Force Reference Atmospheres 0-200 kilometers. Instrumentation developed for combining weather radar and satellite imagery processing will be used for the automated estimation of cloud motion and for integrating these motions to map cloud and precipitation systems. A new algorithm for deriving cloud characteristics from global satellite data will be tested. Testing of the mesoscale cloud and precipitation forecast model will continue. Real time tests simulating Automated Weather Distribution System (AWDS) operations will be conducted.

D. (U) Project: 7600, Terrestrial Geophysics. The objective is to measure and model the earth's geometry, gravity field, dynamics and motions in order to determine their effects on missile targeting and guidance accuracy. Improved resolution and accuracy of global and launch region gravity models will be pursued through novel and efficient measurement and data analysis techniques. Earth motion properties affecting Space Transportation Systems (STS), Advanced Intercontinental Ballistic Missiles (Peacekeeper), and Tactical Air Command (TAC) operations will be defined through field measurements and computer modeling. In FY 1984, the first balloon borne gravimeter flight test was

conducted. This balloon borne gravimeter system will be used to validate gravity prediction methods in missile launch regions. Completed the second vibro-acoustic field program at the Kennedy Space Center. During this field program, arrays of vibro-acoustic sensors were placed at distances mirroring the payload preparation and other major buildings in a shuttle launch environment. In FY 1985, the second balloon-borne gravimeter system flight test will be launched from Holloman AFB using the Global Positioning System for tracking in order to improve the data accuracy. Ground motion measurements will be made at selected sites to determine the effects of seismic motions on the guidance systems of missiles in their silos. Field programs at Vandenberg AFB will monitor the vibroacoustic environment during launch of the Advanced Intercontinental Ballistic Missiles (Peacekeeper). In FY 1986, conduct the balloon-borne gravimeter survey in the vicinity of the Western Test Range to validate the gravity models at high altitudes which should lead to a significant improvement in operational Inter-Continental Ballistic Missile (ICBM) accuracy. Compute the diffraction effects that will determine surface and body wave coupling at crustal transition zones (for example the boundary between the Rocky Mountains and the Great Plains). This work is directly applicable to the propagation of seismic waves into mesa structures, which were suggested as a possible advanced ICBM basing configuration. Initiate seismic hazard studies and modeling of ground motion to assess the earthquake hazards on surface and buried structures.

E. (U) Project: 7601, Magnetospheric Effects on Space Systems. The interaction of the space environment with spacecraft is studied and systems limiting environmental interactions identified. Scientific and technological advances must be made in understanding the regions of space where Air Force systems operate. This includes understanding the solar processes which are the driving force for the natural perturbations, currently emphasis is being placed in the area of the earth's radiation belts. In FY 1984, the radiation ground test program for the Combined Release and Radiation Effects Satellite (CRRES) was developed and ground testing and modeling of the first microprocessor chip was begun. The first direct measurements of high level spacecraft charging at low altitude in the auroral zone were identified on the Defense Meteorological Satellite Program (DMSP) F6 satellite. The model for the average and worst case polar earth orbit space environments, which will be used in the test specifications for polar orbit satellites, was completed. In FY 1985, the Beam Emission Rocket Test-1 (BERT-1), which will provide data on the propagation of low energy particle beams in space and on the use of beams to perturb the space environment, will be launched. The design and fabrication of the Shuttle Auroral Contamination (SAC) sensors, which will be used to obtain data in high inclination shuttle orbits, will be started. The first full year of High Latitude (HILAT) satellite data, which will be used as a data base by researchers will be cataloged. The Space Radiation (SPACERAD) experiment will be completed and delivered to the Space Test Program Office for integration on the Combined Release and Radiation Experiment Satellite (CRRES). In FY 1986, CRRES will be launched. The data gained from this three year mission will be used to evaluate the performance of microelectronics and to expand the models and codes used to define the structure of the radiation belts. The development of a new radiation belt atlas for use in system design will be started. Theoretical studies of particle beam interactions with space plasmas to establish the feasibility of using beam emissions for the perturbation of space plasmas will be conducted. The BERT-1 report, which will describe the low energy particle beam effects on the host vehicle and the environment, will be completed. The verification of the Potential of Large Spacecraft in Auroral Regions (POLAR) Code, which should provide a capability to assess if electrical hazards exist in various space mission scenarios, will also be completed.

F. (U) Project: 7659, Aerospace Probe Technology. This discipline is directed toward improved capability in the balloon, sounding rocket and spacecraft payload systems used as experiment carriers by Air Force Geophysics Laboratory (AFGL) and Department of Defense. The work is not directed toward systems development. It focuses on maximizing the experimental data gathering and payload capability through increased use of micro electronics. In FY 1984, developed a low-cost, high noise immunity, digital command system for inclusion in the standard balloon control devices. This system provides address selection and command-status verification for a capacity of 855 independent commands for inclusion in the standard balloon control devices. An overall system design for a shuttle detached payload which will accommodate most AFGL scientific requirements was completed. This system requires minimum shuttle interface and has the ability to operate both in and out of cargo bay as a closed system. In FY 1985, a scale model of a passive helium cooler for shuttle payloads will be flight tested. Demonstrate that a tethered aerostat Very Low Frequency/Low Frequency (VLF/LF) antenna system can restore communications in a post-attack emergency. Flight testing of the water recoverable, reentry spacecraft, on a Brazilian Sonda IV rocket will be conducted. This reentry spacecraft was produced jointly by the U.S. and Brazilian Air Force. It is a 900 lb payload that will be recovered in the South Atlantic after an 850 kilometer apogee ballistic flight from Natal, Brazil. In FY 1986, the development of a full-scale passive super critical helium dewar will be initiated. A payload-motion sensor will be integrated with a gravimeter and the package will be flown in support of the gravity model verification effort. The design of a new balloon navigation system will be started. Test a dual, microprocessor based automatic payload test/control system, which will provide a highly reliable, real time payload status evaluation during rocket launch countdown testing.

G. (U) Project: 7661, Spacecraft Environment Technology. Define the earth orbit electron and ion populations, develop codes to predict the interaction between the space systems and the orbital environment and develop a prototype spacecraft discharge system. In FY 1984, techniques were developed to control charge build up on low altitude spacecraft operating in polar orbits. Proof-of-concept of the automatic active charge control was demonstrated in laboratory vacuum chamber testing, which simulated a charged rocket immersed in a low density plasma. Completed the development of the Potentials of an Orbiting Large Spacecraft in the Auroral Region (POLAR) Code, a computer model, which can be used to simulate the interaction between Shuttle and the space environment, to include the potential and electron density distributions on and about Shuttle. In FY 1985, a flight test of the automatic charge control system will be conducted on the Beam Emission Rocket Test -1 flight. The verification and validation of the POLAR Code using Shuttle data will be initiated. This Project will be combined with Project 7601 in FY 1986.

H. (U) Project: 7670, Optical/Infrared Properties of the Environment. Develop the data base and technology for the design and operation of infrared/optical surveillance, guidance and laser weapon systems under real world conditions. This includes the effect and limitations of propagation through the atmosphere and of atmospheric and space backgrounds on the range, accuracy and lethality of these systems. In FY 1984, the low resolution transmission code (LOWTRAN 6) which allows one to calculate the atmospheric transmittance as well as atmospheric emission over a wavelength range from the ultraviolet (UV) through the infrared at a spectral resolution applicable to imaging systems and other broadband sensors was published. The first earth limb clutter experiment was successfully flown from White Sands Missile Range in October 1983. The data have been reduced and partially analyzed. The revised Air Force Geophysics Laboratory Infrared Sky Survey Catalog was published. A preliminary celestial model, which is in reasonable

agreement with the preliminary results from Infrared Astronomical Satellite (IRAS) at high galactic latitudes, was defined. In FY 1985, the measurements program, which will specify the atmospheric turbulence properties for laser communications will be completed. A southern hemisphere celestial measurement probe will be flown to complete the coverage required by the Air Force Geophysics Laboratory star catalog at its present level of sensitivity. The mobile Light Detection and Ranging (LIDAR) system will become operational and used to measure atmospheric properties and aerosol distributions which in FY 1986 will support field tests for Space Division (SD) and Aeronautical Systems Division (ASD) programs. In FY 1986, the engineering design and technical evaluation of the space-based LIDAR, which will eventually provide a capability for global coverage of atmospheric optical and meteorological information needed for planning and carrying out Air Force operations, will be completed. Development of the global optical turbulence model, which supports laser communications, will be completed. Conduct the Earth Limb Clutter (ELC II) rocket probe flight which will measure the radiance level of the molecules during enhanced conditions caused by geomagnetic disturbances. Earth Limb Clutter severely affects the performance of anti-satellite and space surveillance systems when it is in the limb viewing geometry.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06GL - Laboratory Operations:

A. (U) Project Description: This project provides for the management and support of the Air Force Geophysics Laboratory, Hanscom AFB, MA, including pay and related costs of civilian scientists and support personnel, transportation, rents, communications and utilities costs, and procurement of supplies, equipment and contractor support services. The Air Force Geophysics Laboratory performs research and exploratory development in the geophysical sciences, i.e., geodesy, geokinetics, meteorology, optical physics, ionospheric physics, upper atmosphere physics, and space physics in support of immediate or potential needs of Air Force operational systems.

B. (U) Program Accomplishments and Future Efforts: Not applicable.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62102F Title: Materials
DOD Mission Area: #523 - Engineering Technology (ED) Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		47,544	49,900	54,769	61,865	Continuing	N/A
06ML	Laboratory Operations	16,229	16,041	16,135	16,970		
2417	Thermal Protection Materials	4,142	4,031	4,340	5,096		
2418	Metallic Structural Materials Materials	9,335	10,179	11,522	12,603		
2419	Nonmetallic Structural Materials	5,142	5,896	6,599	7,848		
2420	Aerospace Propulsion Materials	3,895	3,545	4,266	5,412		
2421	Fluid, Lubricants and Elastomeric Materials	1,418	1,939	2,400	2,989		
2422	Protective Coatings and Materials	2,583	3,521	4,051	4,720		
2423	Electromagnetic Windows and Electronic Materials	4,800	4,748	5,456	6,227		

* Excludes January 1985 Civilian Pay Raise (637).

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Science and Technology program develops new and improved materials which are required to meet the increased performance, reliability and survivability demands of all current and future Air Force aerospace systems. The needs of Air Force aircraft, spacecraft, and missiles are specialized and unique and cannot be satisfied solely by civilian research and development programs. The program also provides management and support for the Materials Laboratory, Wright-Patterson Air Force Base, OH, which is the Air Force agency concerned with all aspects of materials research, development and manufacturing technology.

3. (U) COMPARISON WITH FY 1985 DESCRIPTVE SUMMARY ($)in thousands)

RDT&E	47,344	52,431	56,625	Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Military Construction: Funds	0	18,200	0	0	0	38,800

5. (U) RELATED ACTIVITIES: All three military services, the Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration, the Department of Energy, and industry through the Independent Research and Development program, carry out research and development programs in materials technology specifically related to their requirements. Coordination is provided by the exchange of planning documents, joint agency technical planning committees, and activities such as the Department of Defense Metal-Matrix Composite Steering Committee, the Materials Development Coordination Committee for Advanced Strategic Reentry Vehicles, the Department of Defense Materials and Structures Technology Conference, and the Tri-Service Laser Hardened Materials and Structures Group. These joint planning meetings and materials coordination activities highlight the specialized materials requirements of each organization and are determining factors in the formulation of complementary, nonredundant materials research and development programs. Interface with industry and the technical community is reinforced by active participation in academic and professional organizations and societies. This program element receives specific input from PE 61102F, Defense Research Sciences, and provides technical output to other program elements such as PE 632[illegible]F, Aerospace Structures and Materials, and PE 78011F, Manufacturing Technology.

6. (U) WORK PERFORMED BY: The Materials Laboratory of the Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH, is the organization responsible for the management of this program. The top five contractors in FY 1984 were: University of Dayton, Dayton, OH (2417, 2418, 2419, 2420, 2421, 2422, 2423); General Electric Company, Cincinnati, OH (2417, 2418, 2419, 2420, 2421, 2422, 2423); Rockwell International Corporation, Thousand Oaks, CA (2419, 2422, 2423); United Technology Corp, West Palm Beach, FL (2417, 2418, 2419, 2420); and Westinghouse Electric Company, Pittsburgh, PA (2418, 2423). There are 69 additional contractors with a total FY 1984 face value of over $17 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2417 Thermal Protection Materials and Structures. This project provides materials and processes for thermal protection of Air Force Systems and componentry exposed to intense heat, mechanical stresses, and erosive environments. High performance materials technology is emphasized for future uses on military gas turbine engines, solid rocket and space engine propulsion systems, strategic reentry and decoy systems, and high Mach number aerodynamic vehicles. In FY 1984, several protected carbon-carbon composite technology base programs were initiated to obtain wide

temperature range (up to 2,500°F) and long life (up to 2,000 hours). A silicon carbide coated carbon-carbon containing a silicate sealant experienced only two percent weight loss during 200 hours exposure to cyclic heating effects. Further improvements in inhibited carbon matrices and oxidation resistant fibers and a fundamental understanding of the oxidative behavior of these materials will lead to significant performance improvement. Coating uniformity and deposition onto complex shaped parts were also demonstrated. For advanced solid propellant motors, significant cost and processing reductions were achieved. Fibrous preform weaving time was reduced 75 percent and preform costs were reduced 50 percent using automated weaving machinery. A new generation of hybrid composites for high accuracy reentry vehicles, are nearly developed. One material based on silicon nitride, boron nitride and silica has exhibited good ablation rates and transmission during intense reentry heating. FY 1985 technology goals are to develop and demonstrate new materials and process options for turbine engines, solid rocket motors and strategic decoys. A fully inhibited and coated carbon-carbon composite capable of tolerating cyclic heating for up to 4,000 hours and up to 2,500°F will be demonstrated. A highly reliable composite will be developed for advanced solid propellant nozzles. Subsequent manufacturing methods programs will scale up and demonstrate the reproducibility of the material in full scale applications. FY 1986 goals are to gain a sufficient understanding of the oxidative-mechanical behavior of composite materials to design a full life (several thousand hours) gas turbine engine material for man-rated systems. A lower erosion carbon-carbon composite will be fabricated and demonstrated through subscale motor firings. A radar transmitting material will be fabricated for heatshield uses in advanced missile reentry decoy systems.

B. (U) Project: 2419, Nonmetallic Structural Materials. This project develops new and improved nonmetallic materials, with optimum combinations of properties from cryogenic temperature to 1,200°F, to provide weight savings in aerospace structural applications. FY 1984 accomplishments include advancement of acetylene-terminated resin chemistry to the stage where it is being transitioned to the materials industry for formulation studies; completion of a basic study on sonic-assisted processing, which has demonstrated the enhancement of composites producibility; and successful demonstration of ordered polymer fiber and film. FY 1985 goals include demonstration of new technology, durable bismalemide matrix resins; characterization of the relationship of resin properties to matrix cracking in composite materials; completion of the high temperature composites development for tactical missiles; advancement in processing science to include thick laminate processing; completion of cumulative damage modeling for prediction of composite failure; and aerospace industry evaluation of ordered polymer fibers. FY 1986 goals include demonstration of a new filamentary preform approach for processing thermoplastic composite; completion of feasibility program for innovative techniques to provide 3-D reinforcement in composite laminates; development of process techniques for ordered polymer film materials; and completion of mechanics research to provide definition of the performance of molecular composites.

C. (U) Project: 2420, Aerospace Propulsion Materials. This project provides improved materials and processes for application to current, advanced, and future air-breathing propulsion system components, for both aircraft and missiles. As a result, it will improve producibility, extend durability, reduce acquisition and life cycle costs, increase performance (by increased thrust-to-weight) and reduce fuel usage. In FY 1984, investigations were completed to evaluate the effects of high-cycle (vibratory) fatigue and thermo-mechanical fatigue on crack growth in F-100 engine

components. The results of these investigations have been incorporated into the Probabalistic Life Analysis Technique (PLAT) which is the basis for the implementation of the Retirement for Cause (RFC) program on the F-100 engine. When RFC is implemented in 1986 it is estimated that life cycle cost savings in the F-100 engine will exceed one billion dollars. Also in 1984, the feasibility for developing highly oxidation and thermal-fatigue resistant, diffusion stable, overlay coatings to protect advanced single crystal turbine airfoil alloys at temperatures beyond 2000°F was demonstrated. An iron aluminide-base alloy was identified which successfully incorporated coherent-precipitate strengthening and thus offers promising strength, ductility, and exceptional oxidation resistance. The feasibility for improving fracture toughness of titanium aluminides by heat treatment was demonstrated. The underlying mechanisms which results in strength degradation of carbide-fibers at high temperatures have been identified, and directions defined for improved fiber development (which is being pursued on a related DARPA program). A variety of ceramic-matrix composites were successfully synthesized by hydrolytic decomposition from metal-organic precursors and significant toughness was exhibited by several of these materials. FY 1985 goals include: development of highly reliable thermal barrier coatings process development for crack-growth resistant turbine disk alloys; development and demonstration of improved thermal mechanical fatigue resistant overlay coatings for turbine airfoils; identification of approaches to developing fracture resistant titanium aluminide alloys; and development of life prediction techniques which will model thermal mechanical fatigue and time-dependent crack-growth in engine components. FY 1986 goals include development of alloys which combine features of rapid solidification processing with oxide dispersion strengthening; development of tough, crackgrowth resistant aluminide alloys; development of practical ceramic composites; and development of techniques to characterize fatigue and fracture behavior of titanium aluminides, titanium aluminide composites, and ceramic-matrix composites for future engine applications.

D. (U) Project: 2421, Fluids, Lubricants, and Elastomeric Materials. This project provides materials and supporting technology for lubricants, energy transfer fluids, fluid containment and sealing. In the area of lubrication, materials are developed for liquid, semi-solid, and solid lubricants for aircraft, spacecraft, and cruise missiles along with an understanding and prediction of their performance. In the area of elastomers, materials are developed for fluid containment seals, fuel tank sealants and explosion suppression foams. In FY 1984 advancement of the fluid/seal technology effort for nonflammable hydraulic systems was continued and significant progress was demonstrated by successful completion of a 7.0 hour aircraft pump/actuator test. Programs were initiated to develop high temperature turbine engine fuel/lubrication seals, a more conductive explosion suppression reticulated foam for aircraft fuel tanks, a low temperature Mil-H-83282 hydraulic fluid for current alert aircraft, and advanced mathematical computer models for hydraulic fluids. Other progress included development of lower cost synthesis methods for silahydrocarbon fluids which have potential as base stocks for low temperature Mil-H-83282 fluid development as well as broad temperature range fluids/greases, and development of synthesis methods for high molecular weight Fluroalkylarylene Siloxanylene (FASIL) elastomer which is a required base material for high temperature hydraulic and turbine engine seals. FY 1985 goals are to: accelerate development of 8000 psi nonflammable hydraulic fluid/seal technology for advanced aircraft such as the ATF; develop low temperature, shear stable Mil-H-83282 hydraulic fluid for the B-1B; and continue technology efforts on materials such as silahydrocarbon base stock fluids, FASIL elastomers, and additive packages for higher temperature CTFE

fluids. FY 1986 goals include: completion of the low temperature Mil-H-83282 fluid effort; initiation of an effort to develop high temperature turbine engine face seals; completion of the program to develop a more conductive explosion suppression foam to replace foam used in current aircraft fuel tanks; initiation of an effort to develop a long-life, high-temperature conductive reticulated foam for advanced aircraft such as the ATF; completion of the program to develop a traction model for hydraulic fluids; and initiation of advanced elastomers technology programs to synthesize 600-700 base polymers and develop new elastomer reinforcement techniques which are needed to "Restock the Pipeline"; and continuation of the accelerated CTFE fluid/seal development effort in support of Aeropropulsion Laboratory nonflammable hydraulic system component development programs.

E. (U) Project: 2422, Protective Coatings and Materials. This project provides materials and concepts to enhance the survivability of aircrews and vital components of Air Force systems in natural and induced hostile environments. Although related to the materials needs discussed in other projects, materials considered in this project primarily have a protective function that is essential to the survival of the crew, structure, avionics, and other critical subsystems of the military systems. In FY 1984 the feasibility of laser paint stripping was demonstrated for composite structural materials. Methodology was developed for depositing thin film metallizations on compound curvature surfaces using laser technology. Potential applications of this advanced technology include bandpass radomes and variable geometry chips, which will enhance electronics packaging. Test methods were established for accurate assessment of the contamination potential of spacecraft materials caused by outgassing. Concepts for protection of optical systems against multiple laser wavelengths were further developed. Absorptive dyes for eye protection were incorporated into visors, which were successfully field tested. The pulsed laser test facility was calibrated and shakedown continues. FY 1985 goals are focused on: validation of contamination test methods and establishment of a center to assess the operational effects of contaminants on critical satellite components, such as thermal control surfaces and optics; development of space stable thermal control coatings hardened against laser and nuclear threats; continuation of the effort to develop multi-spectral threat hardened aircraft camouflage coatings; investigation of laser effects on space structural materials; initiation of optical switches and limiter materials development; and characterization of materials response in pulsed laser environments. FY 86 goals include: expansion of the satellite thermal control technology effort to include hardened multi-layer insulation blankets; initiation of an effort to develop high temperature adhesives for solar cells; initiation of an effort for development of increased capability thermal flash resistant coatings for the strategic aircraft fleet; initiation of second generation development of advanced fixed rejection filters; development of concepts for continuing agile wavelength lasers; and further switch/limiter development.

F. (U) Project: 2423, Electromagnetic Windows and Electronic Materials. This project develops materials and material processes for optical, electromagnetic, and electronic subsystems. These materials are required for application to a broad range of electromagnetic and electronic devices and components critical to system operation and/or survival in natural and induced hostile environments. FY 1984 accomplishments were: (1) the largest crystalline boules (single crystal) of cadmium telluride ever grown by the liquid encapsulated Czochralski growth technique were demonstrated for use as substrates for the epitaxial growth of mercury cadmium telluride intrinsic infrared detectors; (2) theoretical modeling of the temperature dependence and the concentration dependence of the donor compensation levels

in extrinsically doped high purity silicon materials for long wavelength infrared detectors was completed; (3) isovalently doped gallium arsenide wafers exhibiting very low levels of defect concentration were used in the fabrication of microwave devices to demonstrate greatly improved material/device processing uniformities in terms of the device threshold voltages; (4) theoretical models of the thermally induced stresses between ceramic chip carriers and printed wiring board materials were established and sample material systems were then fabricated and tested experimentally to verify the models; and (5) coupon sized samples for test and evaluation of fiber reinforced ceramic materials were fabricated and tested to determime applicability for the technology of high dielectric layers of broadband radome designs. FY 1985 goals are: (1) development of vapor phase processes for the deposition of high purity epitaxial layers of mercury cadmium telluride for intrinsic infrared detectors applicable to the mid infrared spectral region; (2) the demonstration of blocked impurity band extrinsic infrared detectors fabricated from ultra high purity silicon and extrinsic dopant materials; (3) demonstration of low defect density, high purity semi-insulating gallium arsenide boules for the fabrication of simple momolithic microwave integrated circuits by reproducible liquid encapsulated Czochralski growths; (4) development of thermally induced fatigue resistant solder compounds for the application of ceramic leadless chip carriers to matched coefficient of thermal expansion printed wiring board materials; and (5) development of ceramic and ablative radome materials for application to broadband radome designs. FY 1986 goals are to develop: (1) optimized detector materials for performance in the mid-infrared and far infrared spectral bands for strategic applications; (2) large area optimized growth techniques for gallium arsenide insulating substrate crystals; and (3) broadband radomes for test and evaluation.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2418, Metallic Structural Materials.

A. (U) Project Description: This project provides reliable metallic materials and processes, with optimum combinations of properties from cryogenic temperatures to 1,500°F, for use in aerospace structural applications. Provides the development and feasibility demonstration of the advanced technologies required to increase productivity for future Air Force manufacturing and maintenance processes. Provides the development and breadboard feasibility demonstration of advanced nondestructive inspection and evaluation (NDI/E) technology for quality and integrity assurance of aerospace materials and structures.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: FY 1984 accomplishments include: the utilization of rapid solidification powder technology to develop a second generation of aluminum alloys possessing a combination of very high strength and superior corrosion resistance and damage tolerance; development of compositions through rapid solidification and thermomechanical processing methods that yield aluminum alloys combining high room temperature strength and balanced fracture properties with suitability for long term use at temperatures up to 450°F, making them a desirable alternative to titanium for

mid-temperature range application and establishing them as a reliable engineering material; identification of approaches to the development of alumminum alloys with a 15 percent density reduction over conventional aluminum alloys; application of rapid solidification methods to the design of titanium alloys with 1300°F capability; initiation of development of a scaleable titanium rapid solidification process based on melt spinning technology; identification of an atomizing process for titanium powder for future evaluation; demonstration of new NDI/E instrument prototypes to accurately detect and image certain critical flaw types in composite and metal propulsion system components; demonstration, in breadboard form, of the adaptability of ultrasonic backscatter techniques to field inspections with contact transducers.

(2) FY 1985 Program: FY 1985 goals include: evaluation of second generation high strength powder aluminum alloys that combine strength in excess of 100 ksi with damage tolerance capabilities; development of first generation very-low density alloys using powder methods; evaluation of conventional ingot approaches to low density alloys; development of processing techniques to allow the high temperature aluminum alloys to be produced in a full range of aircraft structural component shapes; scale up of rapid solidification processes for higher temperature titanium alloys to produce quantities sufficient for the evaluation of the full range of mechanical properties; development of thin-ply graphite/magnesium metal matrix composites, suitable for use on dimensionally stable large space structures; initiate development of corrosion-resistant magnesium-base alloys using rapid solidification approaches; pursuit of promising NDI/E approaches to detect hidden damage in composite structures, hidden corrosion in metal structures and minute cracks in carbon/carbon composite component coatings and development of in-process sensing technique for composite cure process monitoring.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 goals include: the development of a full range of reliability properties in second generation high strength powder aluminum alloys and the demonstration of their applicability to advanced airframe components; scale-up and evaluation of first generation of very-low-density aluminum alloys; development of processes for sheet products of high temperature aluminum alloys to allow them to be used as aircraft skin materials; evaluation of high temperature rapidly solidified titanium alloys; identification of approaches to the development of very thin ply graphite/magnesium components for space structures; continuation of corrosion-resistant magnesium-base alloys development; development of nondestructive inspection technology for the inspection of net shape complex turbine engine components such as bladed discs; development of inprocess inspection of electronic components; continued quick reaction materials and processes (M&P) support to Air Force systems command Product Divisions, Air Force Logistics Command and Operational Commands; transition of improved materials and processes, such as powder aluminu alloys, to systems use; enhancement of analytical and computer support capability to the laboratory research and development program; and continued development of the processing science technology base for automated process control and quality assurance.

(4) (U) Program to Completion: This is a continuing program.

C. (U) MAJOR MILESTONES: Not applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 86

(U) Project: 06ML Laboratory Operations

A. Project Description: The Materials Laboratory plans and executes the Air Force program for materials in the areas of basic research, exploratory development, advanced technology and manufacturing technology. It also provides system support to Air Force product division and operating commands in the areas of technology transfer and systems related materials problems. This project provides for the management support required to operate the Materials Laboratory and includes the pay and related costs of: civilian scientists, engineers and supporting personnel; travel; transportation; rents; communications and utilities cost; and procurement of supplies.

B. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE EFFORTS: Not applicable.

C. (U) MAJOR MILESTONES: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62201F   Title: Aerospace Flight Dynamics
DOD Mission Area: #523 - Engineering Technology (ED)   Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		61,952	64,193	67,545	74,909	Continuing	N/A
06FF	Laboratory Operations	30,255	30,399	30,799	32,434		
2401	Structures and Dynamics	8,403	8,904	9,482	11,059		
2402	Vehicle Equipment	5,436	6,060	6,600	7,600		
2403	Flight Control	8,158	8,755	9,582	11,058		
2404	Aeromechanics	9,700	8,405	9,182	10,658		
3038	Technology Integration and Assessment		1,670	1,900	2,100		

* Excludes January 1985 Civilian Payraise (1,279)

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This exploratory development program is part of the Science and Technology effort which provides the flight vehicle technologies required for the design and development of future aerospace vehicles (aircraft, missiles, and spacecraft) and for the improvement of current vehicles. It encompasses the technical areas of structures, aerodynamics, aerothermodynamics, flight performance analysis, vehicle dynamics, flight control, crew station design, crew escape and recovery, environmental control, mechanical subsystems, survivability/vulnerability systems technology and technology integration, and assessment. The program also provides for the management/and support of the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands):

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	61,192	64,193	66,382		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This program receives technology inputs from In-House Laboratory Independent Research, PE 61101F; Defense Research Sciences, PE 61102F; and Materials, PE 62102F, as well as from other national and international research and development activities. In turn, the technology product of this program is applied to Flight Vehicle Technology, PE 63205F; Aerospace Structures and Materials, PE 63211F; Aircraft Nonnuclear Survivability PE 63244F; Advanced Fighter Technology Integration, PE 63245F; Variable Stability In-Flight Simulator Test Aircraft, PE 64237F and other advanced development, engineering development and system development programs. Cooperative and jointly funded projects are conducted with other Air Force laboratories and organizations, the Army, the Navy, the National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and through the preparation of formal Department of Defense documents such as Technical Area Descriptions and Technical Reports.

6. (U) WORK PERFORMED BY: Work is performed in-house by the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH and through contracts managed by the laboratory. The laboratory makes use of in-house facilities and other Air Force, government, and industry facilities. The top five contractors are Boeing Co., Seattle WA (2401, 2402, 2403, 2404); McDonnell Douglas Co., St. Louis MO (2401, 2403, 2404); Lockheed Aircraft Co., Burbank CA (2401, 2404); Grumman Aerospace Co., Bethpage NY (2401, 2402, 2404); and General Dynamics Corp., Ft Worth TX (2401, 2403, 2404). The total number of additional contractors is 83, with a total dollar value of $12.6 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2401, Structures and Dynamics. Project 2401 focuses on critical structural, dynamic and aeroelastic phenomena which affect the performance, safety, durability and cost of aeronautical, space and aerospace flight vehicles. It sustains the Air Force's Technology Base of structural and dynamic analysis methods, design methods, design data and test methods related to external loads, internal loads, preliminary design, stress analysis, acoustics, vibrations, unsteady aerodynamics, aeroelasticity and applied mathematics for flight vehicles. Project 2401 develops structural concepts, prediction methods, design methods, design data, design criteria and test methods related to the survivability of Air Force structures to combat-induced damage. It develops new structural concepts which meet performance goals related to strength, stiffness and temperature at minimum weight, complexity and cost. This includes the exploitation of new alloys and fabrication processes; graphite/epoxy composites; high-strain, high temperature composites; and metal matrix composites which are used on the structures of aircraft, missiles, maneuverable reentry vehicles, surveillance satellites, weapon satellites, boosters and orbital transfer vehicles. FY 1984 accomplishments include: (1) the development of thermo-structural analysis methods which are used to predict the response of aircraft structures to intense laser radiation; (2) completed the design of cryogenically fueled high temperature structures for maneuverable reentry vehicle; (3) demonstrated the Aircraft Ground Induced Loads Excitation (AGILE) ground test facility to evaluate the dynamic response of fighter aircraft to damaged and repaired airfields; and, (4) developed alternative high energy heat sources to simulate (at low cost) the effects of laser weapons on aircraft structures.

FY 1985 projects include: (1) fabrication and testing of radar-absorbing structural concepts for aircraft leading edges and fuselage sections and for cruise missile airframes: (2) development of a conceptual model for a computerized battle-damage assessor system; (3) demonstration of structural concepts for survivable, composite integral fuel tanks; (4) provide guidance for the operational use of A-7, A-10, F-16, F-111, and C-5 on damaged airfields; (5) exploit the Aircraft Ground Induced Loads Excitation (AGILE) test system for the A-7 and F-15 combat aircraft; (6) demonstration of reduced take-off ground rolls for USAF fighter aircraft with ski-ramp takeoffs; (7) completion of a design guide for composite structures with bolted joints and test structural concepts for high temperature, maneuverable reentry vehicles; and, (8) development of sensors and actuators for the vibration control of large space structures. FY 1986 planned projects include: (1) initiation of a contractual program to develop a computerized assessor system and an updated repair guide to replace the voluminous and unwieldy Technical Orders which govern repair of battle-damaged structures; (2) wind tunnel test the final set of computer algorithms for the application of adaptive controls to suppress the flutter of wings with arbitrary external stores; (3) structural concepts will be defined to get the maximum performance benefits of high-strain composites, high temperature composites and thermoplastic structures for advanced tactical fighters without sacrificing reliability and maintainability; (4) the results of recent R&D and the accumulation of field experience with sonic fatigue of secondary structures will be converted to a handbook for structural designers; (5) a program will begin to settle the question of whether the results of small-scale fatigue tests on graphite-epoxy specimens can be scaled to reliably predict the fatigue-life of full scale composite structures; (6) a major new in-house/contractual initiative will be undertaken to develop the technology to design, analyze, fabricate and test large-scale, hot structures for boost-glide and/or manned, maneuverable reentry vehicles; (7) basic research on thermo-structural analysis and structural optimization for surveillance satellites will be followed by the exploratory development of combined analysis and design commputer programs which will design minimum weight structures in the presence of thermal loads and active/passive control of vibrations; (8) laboratory hardware will be developed, for weapons satellites, to demonstrate active control of the vibratory response of laser mirrors; (9) efforts will begin to upgrade our structural analysis methods, data bases, methods to predict and suppress unwanted vibrations, and computer methods to predict the flutter of aircraft at transonic speeds; and, (10) increase in-house experimental capabilities to include static/dynamic tests of maneuverable reentry structures and weapon-satellite structures.

B. (U) Project: 2402, Vehicle Equipment. The purpose of this project is to acquire the technological base and provide demonstrated technologies in the areas of: (1) conventional and alternate flight vehicle take-off and landing systems; (2) windshields and transparency enclosures; (3) cryogenic cooling; (4) internal environmental control; (5) flight vehicle vulnerability to ballistic threats and natural environmental hazards; (6) emergency crew escape; and, (7) combined environmental reliability assessment and testing. These technological advancements will significantly affect the life cycle cost of subsystems and equipment, increase the probability of flight vehicle and crew member survival, and improve flight vehicle operational capabilities. In addition, the project will demonstrate options for improved equipment and subsystem design and performance and establish the associated scientific and engineering foundation for these technologies. FY 1984 accomplishments include: (1) the feasibility demonstration and performance evaluation of a full scale air cushion equipment transporter capable of moving payloads up to 60,000 pounds over soft and battle damage repaired terrain was successfully completed with a fully equipped and loaded F-101 aircraft as the demonstration

vehicle; (2) a survivable fuel system design guide was published which comprehensively describes methods and techniques to harden fuel tanks and dry bay areas to prevent or suppress ballistically ignited fires; (3) computerized analyses programs for aircraft transparency and environmental control systems were developed and are operational; (4) in the critical area of cryogenic helium liquefiers for space surveillance and superconducting sensor devices, critical components for use with a 4.2° Kelvin (K) helium liquefication system were developed and evaluated in the Laboratory; and, (5) concept definition studies of selectable thrust propulsion rockets and thrust vector controls for ejection seats were completed and the results transferred for potential application under the Crew Escape Technologies (CREST) Program. FY 1985 projects include: (1) the development of a digital flight control/vectored thrust control concept, to provide regulator control of an ejection seat/occupant system about the yaw, pitch and roll axes, will be completed with the hybrid simulation and its performance evaluation employing a breadboard system; (2) cost effective techniques, based on infrared and holographic principles to detect environmentally inducted defects on electronic circuit boards, will be developed and demonstrated for production line environmental stress screening; (3) the development of major components and their integration into an F-16 production type landing gear for rough/soft/short field operation, the development of a microprocessor based controller for an integrated brake control system, and the development, under a joint U.S./ Canadian program, of a vapor cycle type closed environmental control system are continuing; (4) the definition and comparative evaluation of potential concepts for Chemical/Biological (CB) contamination avoidance in aircraft as an integral part of a closed environmental controls system will be completed; and, (5) the development of a vibration reliability model and vibration/reliability relationships which will establish the relationship between induced vibration environment stress and the packaged electronics reliability will continue. FY 1986 planned projects include: (1) evaluation, in the Laboratory, of an F-16 landing gear modified to provide a rough/soft/short field operating capability and a microprocessor based integrated brake control system to combine the functions of steering, rudder control and braking; (2) continue the definition of concepts and preliminary designs for an advanced crew escape capsule for potential application to high performance aircraft and for a transparent crew enclosure concept in which the fuselage attachment structure becomes an integral molded extension of the transparent panel; (3) the experimental evaluation and analysis of the combined effects of ballistic impact of a variety of combat threats and windblast on composite structures which contain fuel will be completed; (4) a comparative assessment will be conducted to determine the effects of atmospheric lightning and Nuclear Electromagnetic Pulse (NEMP) on aircraft internal electronics and avionics; (5) the design, development, and evaluation of a Chemical/Biological (CB) contamination avoidance system for integration into a closed environmental control system will be initiated; and, (6) the development of a 4.2K° helium liquefication system will continue and the Laboratory evaluation of a small, very high speed/high efficiency turboexpander for operation in multi-stage cryogenic refrigeration in a space environment will be completed.

C. (U) Project: 2403, Flight Control. This project develops control theory, performs aerospace vehicle simulation and analysis, designs cockpit controls and display concepts, develops aircraft and missile stability and control methods develops new control sensors and actuators, integrates flight control with propulsion/navigation/weapon delivery systems and develops specifications, handbooks and flight control system design and analysis methods. This project is needed to meet the stability and flight path control requirements of advanced flight vehicles, to obtain the maximum performance for these vehicles throughout the flight envelope, to match the vehicle characteristics and the cockpit displays and

controls to the pilot's capabilities, and to provide for maximum flight safety and battle survivability. Project 2403 develops concepts which are flight demonstrated in Flight Vehicle Technology, PE 63205F and Advanced Fighter Technology Integration, PE 63245F and technology which directly transitions to weapon system applications. FY 1984 accomplishments include: (1) two Multifunction Flight Control Reference System (MFCRS) ring laser gyro inertia reference assemblies were delivered for flight tests in an F-15 to evaluate projected performance improvements and increased reliability at an eventual lower life cycle cost; (2) an automotive microprocessor was adapted for aircraft control systems and test flown in an unmanned research vehicle demonstrating the applicability of these rugged, low cost, high production volume components for aeronautical vehicles; (3) two advanced fighter cockpit concepts were evaluated and the results were provided to Aeronautical Systems Division (ASD) for advanced fighter developments; (4) the frequency range of the F-16 control actuator was increased to meet the requirements of the X-29 in the hydraulics actuation laboratory and a new embedded linear position transducer was built and tested; (5) the first computerized expert maintenance diagnostic system was demonstrated for one of the F-15 control system fault trees and further development was transitioned to an advanced development program; (6) fault detecting, self-repairing flight control system developments were transitioned to 6.3 programs; (7) new display concepts were tested in a new computer controlled cockpit to evaluate emergency procedures, speech interactive control and electronically generated maps and navigation aids; (8) the first three-color flat panel Light Emitting Diode (LED) display was evaluated in the laboratory; (9) the first 1" x 3" Air Force flat panel display was transitioned into the F-16; and, (10) a survivable low level aircraft penetration was simulated in real time generating a terrain following/terrain avoidance trajectory using feasible directions algorithms. This was a first time application of automatically generated deviations, from a straight line trajectory, to take advantage of the cover offered by flying in valleys through mountainous terrain. FY 1985 projects include: (1) completion of the final simulations for the Integrated Tactical Flight Management programs evaluating fighter cockpit displays and the automated controls for air-to-air and air-to-ground missions; (2) completion of the first pilot decision aids study evaluating the application of artificial intelligence to real time inflight tactical air missions, an initial step in a major long term effort applying artificial intelligence technology to flight control (3) completion of the competitive evaluation of voice vs tailored keyboard data input for advanced control systems in the crew systems laboratory; (4) demonstrate a new holographic Heads Up Display (HUD) with increased brightness for sunlight operations in a fighter cockpit; (5) complete the Variable Stability In-Flight Simulator Test Aircraft (VISTA) design study for the FY 1986 VISTA development initiation; and, (6) deliver the final preparatory Short Take Off and Landing (STOL) flying qualities criteria landing system study and stability and control methods developed for the STOL advanced development program. FY 1986 planned projects include: (1) exploratory developments emphasizing technologies essential for new mission capabilities (e.g., night in weather penetration and attack, large space structures pointing, skewing, and vibration control and controlled maneuverability beyond stall); (2) the changing role of the pilot from a machine controller regulator to a mission manager using cockpit automation, artificial intelligence and correlated and integrated pictorial displays; (3) provision of mission essential functional reliability through fault tolerant system architecture and ultra reliable components; and, (4) the continuing absolute requirement for the extreme reliability of all systems which are flight safety critical. New technologies, such as artificial intelligence, will be applied to trajectory and attitude control functions for combat missions to improve effectiveness and survivability. Robust control theory advancements will be pursued with in-house and contracted programs to apply new control theories to the large

distributed systems found in flexible aircraft and large space vehicle structures. Positive dynamic control of aircraft maneuvering above the stall angle using thrust vector and flow control techniques will be studied to expand maneuvering capabilities that provide military advantages. Reconfiguring control system architectures and Very High Speed Integrated Circuits (VHSIC) applications will be investigated to create more fault tolerant system designs. Technical base efforts such as voice control, flat panel displays design methods, simulator studies of Short Take Off and Landing (STOL), and air-to-ground weapon delivery, flying qualities research and advanced control sensors and actuators will be pursued to fill the gaps and create new potential for the integrated control of advanced flight vehicles.

D. (U) Project: 2404, Aeromechanics. The purpose of this project is to plan and conduct technology programs in the area of aerodynamics, aerothermodynamics, performance analysis, configuration research, wind tunnel and flight experiments. These technology programs are directed toward improved mission capability and survivability, reduced development risk, and reduced development and operation cost. Fundamental technology base efforts include development of: (1) test and prediction techniques; (2) design criteria; (3) wind tunnel simulation and flight test correlation; and, (4) configuration and component options to enhance mission performance. FY 1984 accomplishments include: (1) completion of both wind tunnel tests and Radar Cross Section (RCS) range tests which defined the drag levels for air-to-air weapons through the supersonic speed regime and the RCS contributions of externally carried weapons have been quantified; (2) several efforts have been completed in the airframe/propulsion integration area such as design criteria for the integration of thrust reversers into near term aircraft; (3) predictions of the Boost Glide Vehicle (BGV) capabilities have been verified through a series of wind tunnel tests; (4) a unique area of investigation just completed is the application of fluid mechanic principles as a countermeasure to laser weapons; by injecting different absorbers in the boundary layer we have shown that significant levels of laser energy can be attenuated; and, (5) the technical feasibility of air-launching a hypersonic vehicle from a large subsonic aircraft has been completed. FY 1985 projects include: (1) the completion of the advanced weapon carriage concept program which emphasizes concepts which minimize drag and RCS utilizing more near term weapons; (2) the nozzle investigation for supercruise application will continue with concept development, analysis and final selection of concepts for experimentation; (3) a wind tunnel model which will be used to validate the National Transonic Facility (NTF) will be completed; (4) an analytical model is being developed to aid in the analysis of jet interactions such as vector nozzle or blowing; (5) examine the lessons learned on the Space Shuttle and how we can apply this technology to the design of future hypersonic vehicles; (6) concept definition and identification of needed technologies for Boost Glide Vehicle will be completed; and, (7) several efforts in the fighter configuration area are being completed such as the compact survivable fighter configuration program, and the alternate take-off and landing options. FY 1986 planned projects include: (1) a joint effort with the Aeropropulsion Laboratory where ramjet technology will be integrated with the long range, high speed, survivable configuration work of the Flight Dynamics Laboratory; (2) efforts in the analysis methods area relating to Ballistic Missile Office (BMO) decoys will be completed; (3) a major activity on hypersonic vehicles will be initiated bringing together the aerodynamic and aerodynamic heating efforts as well as system constraints conducted in prior years to provide a firm foundation of design data and component effects data; (4) the missile design methods activity, which will define the best methods depending on the configuration and flight conditions will be completed; and, (5) a program examining the possibilities for large aircraft of the future will be completed.

E. (U) Project: 3038, Technology Integration and Assessment. This project performs advanced concept synthesis and technology integration and assessment functions which, through scenario based strategies, focuses military capability and state-of-the-art technologies to identify future military options along with technology required for applications. Technology integration and assessment is accomplished through systems and technology relevant cost/benefit analysis, operational requirements/technology, opportunity tradeoffs, and conceptual/preliminary designs of flight vehicles which provide a rationale for transition of technology and planning. The FY 1985 project will develop in-depth concept data bases, along with inhouse design and analysis methods, support the Air Force Wright Aeronautical Laboratories (AFWAL) Major Thrusts and technology assessment leading to investment strategy rationale. The major areas of emphasis include: (1) definition of future air combat and expansion of the data base through development of new concepts and new combat models which utilize the full capability of supersonic persistence, reduced observables, advanced weapons and threat avoidance maneuvering; (2) the tactical utility of space will be investigated and the problems of worldwide tactical operations will be addressed in the Sortie Generation 2000 study; (3) mission related studies will be initiated in the areas of advanced airlift, "2010 Fighter and Defense Suppression;" (4) Radar Cross Section (RCS) prediction methods development will continue; (5) a new program to improve aircraft weight estimation methods will be initiated; and, (6) support of the Aircraft Survivability Center and Modular Life Cycle methods will continue. FY 1986 planned project will develop the rationale for Laboratory Investment Strategy, develop the military relevant concept data base for technology assessment, develop analysis and design methods and will continue to support the AFWAL Major Thrusts. The specific efforts will be integrated into three major goals: Global Tactical War Fighting, Control of Space, and Technology of Systems/Integration. The objective of the "Global Tactical War Fighting goal is to obtain a balanced assessment of the total worldwide tactical needs and to understand the key operational and system drivers as a function of given conditions and opportunities of future development. The assessment efforts will deal with the issues of timely deployment to the crisis area, intratheater employment, logistics and supportability as a function of the operation issues and levels of conflict intensity. The objective of the "Control of Space" goal is to investigate and to assess the technological and operational issues and considerations associated with the nonnuclear military use and control of near earth space. The primary concerns are with basing, launch, orbital and recovery survivability, and weapon(s) use and delivery in selected nonnuclear strategic and tactical scenarios. The assessment will determine in a parametric manner the value of vehicles that can conduct military operations with equal effectiveness in space Low Earth Orbit (LEO) and in the atmosphere. Technology of Systems and Integration has five methodology areas (design, vehicle characteristics prediction, mission analysis, operational effectiveness and cost effectiveness). The objective of this element is to develop methods in these areas, to integrate these methods, thus making the process flow, to develop the understanding to choose the most appropriate methods for the task at hand, and to develop the knowledge and experience to properly interpret the results generated by these methods. Specific efforts in support of this goal are the initiation of aircraft survivability modeling, initiation of a Radar Cross Section (RCS) prediction method development for low observable concepts, configuration of the improved weight estimation methodology, reliability and maintainability in life cycle costing and initiation of advanced design prediction methods.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06FF, Laboratory Operations.

A. (U) Project Description: This project provides for the management and support of the Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. It includes pay and benefits for civilian scientists engineers and support personnel; travel, transportation, rents, communications, computer network, and utilities costs; and procurement of supplies, equipment and contractor support services. This project supports and compliments the other projects in this program element.

B. (U) Program Accomplishments and Future Efforts: Not applicable.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62202F
DOD Mission Area: #522 - Environmental and Life Sciences (ED)

Title: Aerospace Biotechnology
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 87 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		42,954	45,000	50,840	57,262	Continuing	N/A
06MD	Aerospace Medical Division Laboratory Operations	21,983	22,262	21,602	23,006	Continuing	N/A
2729	Chemical Defense	3,350	3,340	4,120	4,600	Continuing	N/A
6302	Occupational & Environmental Toxic Hazards in AF Ops	2,740	2,900	4,030	4,580	Continuing	N/A
6770	Biotechnology Studies in Advanced Systems	297	800	1,675	1,910	Continuing	N/A
6893	Manned Weapon Systems Effectiveness	1,550	1,760	2,135	2,760	Continuing	N/A
7184	Man-Machine Integration Technology	4,179	4,087	4,825	5,580	Continuing	N/A
7321	Safety and Aircraft Effectiveness in Mechanical Forces Environments	3,035	2,992	3,745	4,530	Continuing	N/A
7755	Aerospace Medicine	854	947	1,210	1,506	Continuing	N/A
7757	Radiation Hazards in Aerospace Operations	3,300	3,761	4,400	5,230	Continuing	N/A
7930	Advanced Crew Technology	1,666	2,151	3,098	3,560	Continuing	N/A

*Excludes January 1985 Civilian Pay Raise (548)

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Aerospace Biotechnology is the core Air Force technology base program to optimize the role of the human operator in the design, development, and operation of increasingly complex and technologically sophisticated weapon systems. The five key goals for the biotechnology program are: (1) to improve the performance of the human component of weapon system/operations by refining crew selection, crew protection, and man-machine integration; (2) to improve personnel safety and environmental protection from radiation as well as from chemical and mechanical forces; (3) to establish threat characterization and countermeasures effective against Soviet weapon systems; (4) to develop chemical defense measures for air base operations, casualty care evacuation, and personal protective equipment; and (5) to exploit and optimize man's utility in military space systems, enhance man's integration into military space systems, and insure crew protection in military space environments.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	42,114	47,382	52,217		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Military Construction Funds	510	3,450	0		Continuing	N/A

5. (U) RELATED ACTIVITIES: The biotechnology program is formally coordinated with the Army, the Navy, the National Aeronautical And Space Administration through a variety of mechanisms including the Tri-service Aeromedical Research Panel and the Human Factors Engineering Technical Advisory Group. Where coordination is required on a daily basis, operating locations have been established with other organizations. These include positions with HQ Army Medical R&D Command, Fort Detrick MD, Army Institute of Chemical/Biological Defense at Aberdeen Proving Ground MD, Army Aeromedical Laboratory, Fort Rucker AL, Naval Medical Research Institute, Bethesda MD, and NASA (JSC). Strongly related program elements include 62720A Environmental Quality Technology, 62777A Systems Health Hazard Prevention Technology, 62205F Training/Simulation Technology, 63227F Advanced Simulator Technology, 63365F Space Biotechnology, 63745F Chemical Warfare Defense, and 64703F Aeromedical Systems Development.

6. (U) WORK PERFORMED BY: The biotechnology program is conducted by the Aerospace Medical Division, Brooks Air Force Base, Texas and Wright-Patterson Air Force Base OH. The five major contractors are: University of California at Irvine, Irvine CA (Project 6302); Systems Research Laboratories, Inc., Dayton OH (Project 7184); Southeastern Center for Electrical Engineering Education, St Cloud FL (Projects 7755, 7757, 7930, 2729); Science Application, Inc., La Jolla CA (Project 7184); System Develop Corp, Santa Monica CA (Project 7184). There are an additional 53 contractors with total contract value at $14.9 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2729, Chemical Defense. Fully coordinated with the Army as lead DOD agency, this project addresses needs that are specific to Air Force operations. It includes technology based efforts designed to insure continued effectiveness of air operations and aeromedical care in the event of a chemical attack. FY 1984 accomplishments include: (1) a revised first-generation Commanders Guide for Chemical Warfare for United States Air Forces in Europe; (2) criteria for ground crew cooling and an improved ground crew liquid cooling system design; (3) demonstration of the visual and psychomotor effects of pyridostigmine; (4) criteria for a casualty ventilator; and (5) F-16 chemical warfare vulnerability analysis. The FY 1985 efforts will (1) determine the trade-offs

associated with protective posture and mission effectiveness allowing a decision logic structure for contamination control; (2) integrate and evaluate the AR-5 aircrew respirator; (3) test and evaluate the aircrew member's performance in the protective ensemble; (4) compare four chemicals for speed, accuracy, ease of use, and detection; (5) continue study of toxicological effects of agents, toxins, and antidote/ pretreatment drugs; (6) complete Second Echelon biomedical data acquisition systems design; (7) develop and test a charcoal undergarment two-layer concept for ground crew ensembles; (8) synthesis and characterize resin polymers for advanced detection technology; (9) model combined chemical/conventional casualty; and (10) measure effects of pyridostigmine at altitude and during acceleration. The FY 1986 program includes investigating the technology for (1) powered air mask and hood fabrication and test; (2) lightweight filter blower design; (3) advanced ground crew body cooling system design; (4) coating development for microsensors; (5) laboratory screens, aircraft simulator, and in-flight tests of the effects of pyridostigmine on aircrew performance; (6) medical Survivable Collective Protection System (SCPS) processing procedures completion; (7) collective protection trade-off analysis; and (8) year 2000 air base vulnerability assessment. FY 1986 new starts will include: (1) development of an anolog to assess the predicted combined effects of antidote/pretreatment drugs and chemical agent challenge to aircrew and ground crew performance; (2) electro-optical techniques for agent detection; (3) gaseous volume decontaminant development; (4) portable body scanner breadboard design; (5) a mobile, survivable radio frequency radiation (RFR) system procedure and processing study; and (6) detection/warning/identification trade-off analysis.

B. (U) Project: 6302, Occupational and Environmental Toxic Hazards in Air Force Operations. This project maintains sole research and development responsibility within the Air Force for the toxicological assessment of Air Force materials and critical processes that may be associated with advanced Air Force systems operations. Activities include: systematic studies of toxic hazards; determination of biological, toxicokinetics, and pharmacological bases of toxicity; establishment of human tolerance levels for engineering design; determination of exposures effects on performance; identification of potential environmental toxicology problems; and development of toxicologic methodologies and protocols. Acute, chronic, teratogenic, and long-term oncogenic studies are performed. FY 1984 accomplishments include the establishment of health exposure criteria for petroleum JP-4 and the completion of selected toxicolcgical exposure studies for the fuels JP-TS (thermally stable), JP-7, and shale-derived JP-4. Toxicity exposures were completed for surfactants used in slurry fuels and toxicokinetic studies were completed for the high-energy cruise missile fuel JP-10. Plans for FY 1985 include the development of health exposure criteria for JP-TS, JP-7, and the synthetically derived carbon-slurry fuel. Toxicokinetic modeling efforts will be extended to include mixed hydrocarbon exposures. Toxicological studies on metallic slurries (high-energy fuel) will be started. Studies will be initiated to assess health hazards associated with groundwater contaminants, and recommendations will be made with respect to appropriate action levels. In FY 1986 toxicological exposure studies for metallic slurry fuels will be completed. Work to establish appropriate exposure criteria for shale JP-4 will be continued. Efforts will be continued to couple toxicokinetic modeling with pharmacodynamics to arrive at does-response relationships. Work will be continued to assess a wide variety of Air Force industrial chemicals and materials (e.g., hydraulic fluids, lubricants) with respect to health exposure criteria.

C. (U) Project: 6770, Biotechnology Studies in Advanced Systems. This project supports those general objectives of the Aerospace Biotechnology Program which do not fall logically under the responsibility of a single subelement of the Aerospace Medical Division and are, therefore, managed at Headquarters, Aerospace Medical Division. Four categories of effort are involved: (1) Air Force participation in support of activities such as the National Research Council (NRC); (2) activities directed by higher headquarters requiring timely integrated responses for several subelements, such as specific requests for research and development from operational commands; (3) new interlaboratory programs during the planning and preliminary stages, and (4) joint service/agency efforts to develop short-term products of mutual benefit such as technology sharing or hazards control handbooks for common operations. FY 84 accomplishments include the initiation of long-range developmental planning studies in the areas of military space biotechnology, advanced life support, and advanced training concepts. Support activities include the National Academy of Sciences (NAS)/Nuclear Regulatory Commission (NRC) Institute of Laboratory Animal Resources, the joint Service Committee on Hearing Bioacoustics and Biomechanics, the Tri-service Human Factors Engineering Technical Advisory Group, and the European Office of Aerospace Research and Development (EOARD) Window-on-Science Program. FY 1985 plans include completion of the two year study on military space biotechnology, and continued support of the NAS/NRC Institute of Laboratory Animal Resources, the Armed Services Biomedical Research Evaluation Management Committee, and the EOARD Window-on-Science Program. In FY 1986, the program will continue support to these same activities. In addition, the program includes review/support for the AMD post-doctural program, external peer review for selected areas ensuring compatibility of AMD procedures with USAF Scientific Advisory Board recommendations, and continued quick-response technology base products to advanced/engineering development programs and to operational commands.

D. (U) Project: 6893, Manned Weapons System Effectiveness. This project determines and evaluates the interactive effects of crew performance capabilities on manned weapon systems survivability, threat system effectiveness and human countermeasure capabilities for system concept definition and design. It incorporates man-in-the-loop and computer simulation procedures for assessing the merit of competing manned weapon and threat system designs, develops effective countermeasures against threat crew systems and develops effective camouflage, concealment and deception mechanisms. FY 84 accomplishments include the development of aircraft, decoys, radar reflectors and runway camouflage paint schemes for airbase survivability testing. Threat command, control and communications (C^3) system simulations were developed for interactive systems testing. Integrated flight and fire control system algorithms were evaluated and refined. The effects of low-level laser systems on crew performance was determined and provided to system developers. A visual function tester was developed to assess the effects of space flight on crew member visual processes. FY 1985 efforts include the development of workload measurement technologies as applied to command, control and communications (C^3) systems and to an optimized, standardized C^3 crewstation. Efforts will begin in countermeasures technology for threat C^3 systems and a dedicated human engineering effort addressing space problems will begin. The development of the underlying technology for an optically based terrain avoidance/terrain following system will continue. In FY 1986 work will continue to develop new camouflage, concealment and deceptive technologies. The effect of threat countermeasures on aircrew performance will be determined. Work will begin on a

cockpit threat information management display and other adaptive decision aiding systems for aircrew. Human performance capabilities and opportunities for utilization of man-in-space will continue to be investigated.

E. (U) Project: 7184, Man/Machine Integration Technology. This project develops methodologies and technologies to maximize the efficiency and effectiveness of the human operator interface with Air Force systems. Basic information about the perceptual, cognitive and response characteristics of human operators is developed within mission specific scenarios. This data drives the development of human centered design point data for system control and display design. Standardized methodologies are also developed to assess the improvement in weapon system performance due to optimized man-machine coupling. FY 1984 accomplishments include development of a night vision goggle head-up display for critical flight information, a B-52 flight deck design simulation and workload evaluation, and the methodology to permit determination of the tactical worth of proposed attack system enhancements early in system design. FY 1985 plans include the human engineering design reconfiguration of the North American Air Defense Command (NORAD) command post, the development of a LHX helicopter virtual image cockpit, and chemical defense protective equipment fit and sizing systems. New efforts will begin on design simulations for the B-1B defensive stations, the Defense Advanced Research Projects Agency (DARPA) artificial intelligence based pilots' associate system and the relocatable targets program. In 1986 the B-1B design engineering research simulator will be completed and transitioned to SAC. Development of a neurophysiological test battery will be completed and the system validated. Work will continue in the pilots' associate program, the relocatable targets program and the development of technology for a standard drug screen performance test battery, dynamic display design system, helmet mounted displays for fighter applications, virtual cockpits and automated human engineering data base and crew station design capability.

F. (U) Project: 7231, Safety and Aircrew Effectiveness in Mechanical Forces Environments. The objective of this project is to assure the mission effectiveness, safety, and health of personnel exposed to hazardous mechanical forces created by Air Force ground and flight operations. These forces include sustained and impact acceleration, vibration, and noise. Tasks within this project include exploratory development for advanced escape/ejection technology, advanced voice communications/jamming technology, environmental noise technology, sustained acceleration protective systems, impact injury research, and advanced dynamic modeling of impact accelerations. FY 1984 accomplishments include development and initial validation of a unique protective system to prevent windblast injury during high G speed ejection, an advanced microphone and aircrew oxygen mask to improve the input quality of the digital voice communications systems, and an evaluation of the effect of voice communications jamming systems on foreign languages. A physiologically based voice communication jammer has been transitioned to advanced development. FY 1985 plans include the initiation of research and development to provide technology for a very high speed, "high mach" ejection system, research to optimize voice communications in a narrow channel digital communications systems, and environmental noise/sonic boom evaluations for supersonic training areas. The FY 1986 program will include an increased emphasis on the human aspects of electronic warfare and communications jamming and counter-jamming. Initial evaluations of high mach ejection/escape technology will be conducted utilizing in-house test equipment. Environmental noise modeling efforts will be expanded to include validated data on lateral sound attenuation and

sonic boom information from previously initiated programs. Initial technology in pilot incapacitation/warning will be available for test and evaluation. Engineering specifications and prototypes of the dynamic manikin will be available for advanced program testing.

G. (U) Project: 7755, Aerospace Medicine. This project develops methods to insure: (1) the best medical selection criteria are applied to applicants for Air Force Undergraduate Pilot and Navigator Training; (2) detection and prediction of the early onset of disease in aviators; and (3) refinement of retention criteria to optimize and increase the "cockpit longevity" of the USAF flyers. FY 1984 accomplishments include the completion of studies to validate contrast sensitivity measures and studies of sarcoid cardiovascular risk, acquisition of a nuclear medicine data system, continuation of risk identification studies for flyers, and vestibular baselining on manned space flight engineers. In FY 1985 a significantly enhanced biofeedback treatment capability will be achieved and a prototype situational awareness training protocol will be developed. A new waiver and follow-up criteria for mitral valve prolapse will be defined and the utility of contrast sensitivity as a visual standard will be determined. The FY 1986 program will measure coronary perfusion and myocardial performance under G Stress. This technology addresses operational concerns of loss of consciousness for rapid high-G loading in high performance aircraft. An Air Force risk index as a first-order screen for coronary artery disease will be validated and implemented. This will greatly impact aircrew selection with cost savings to the Air Force. Studies using digital subtraction angiography and the accomplishment of a Holter monitoring data base will contribute to this goal.

H. (U) Project: 7757, Radiation Hazards in Aerospace Operations. This program assesses and quantifies the biological effects of radiofrequency (RFR), ionizing, laser, nuclear flash, and particulate radiation on Air Force personnel. It performs personnel hazard assessments, defines safe separation distances, develops protective devices, and prediction of air and ground crews' ability to perform in a radiation environments. FY 1984 accomplishments include the establishment of operational exposure guidelines for female workers, and the determination of peak pulse power effects on RFR exposure standards. FY 1985 efforts will determine the bioeffects of millimeter waves, very low frequencies (VLF), and long term, low-level RFR. Development of methods for assessing the air crew performance decrements associated with combined ionizing radiation and dilute chemical agents will be continued. An effort to develop an ionizing radiation model for space crew sickness will be continued. Development of countermeasure methods and devices for crew protection from laser radiation will be continued and the visual function degradation associated with laser radiation will be determined. Nuclear fallout dose mitigation studies will be continued. In FY 1986 efforts will continue to develop directed energy bioeffects exposure criteria for repetitively pulsed laser energy, high-energy pulsed radiofrequency radiation, and particle beam radiation. Studies will be continued to determine nuclear (non-directed) bioeffects/performance effects on aircrew vulnerability. The Post Attack Command and Control (PACC's) -National Emergency Airborne Command Post (NEACP) Dose Fallout mitigation work will be continued. Efforts on the development of laser countermeasure devices/materials will be continued.

I. (U) Project: 7930, Advanced Crew Technology. This effort provides biotechnology and applied physiology to insure the protection and effective use of Air Force crews for advanced and future weapon systems. Effort supports goals of: (a) advancing life support equipment to fulfill current and future Air Force requirements; (b) reducing

aircraft mishaps attributed to human errors; (c) advancing aeromedical evacuation systems and related Air Force specific medical systems; and, (d) maintaining a current technology base. The overall goals of this objective are to develop breadboard systems or procedures that can be transferred to appropriate advance development agencies with reasonable confidence of success. FY 1984 accomplishments include an evaluation of advanced flight control instruments and pilot performance, establishment of pressurization requirements for full pressure suits to prevent decompression sickness. A computerized system for data storage and evaluation of aircraft mishap and near mishap information was also developed. FY 1985 efforts will expand the tissue oxygenation program to acquire advanced equipment and initiate validation studies, develop a breathing pressure versus acceleration schedule to improve acceleration tolerance, complete the development program addressing the human factors causes associated with aircraft accidents. Equipment performance requirements for rapid G-onset accelerations will be established. The FY 1986 program will in man rating and flight testing of advanced life support systems. It will establish the physiological effect of very high G onset acceleration and initiate programs to provide advanced anti-G protection. Studies of pharmacological intervention to improve aircrew altitude and acceleration tolerance. Develop advanced research methods to study decompression sickness and to evaluate spatical disorientation.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06MD, AEROSPACE MEDICAL DIVISION LABORATORY OPERATIONS

A. (U) Project Description: This project provides for the management and support of the Aerospace Medical Division research laboratories. The laboratories are designed to specifically define man's limits with regard to adaptability, survivability, and performance capabilities within his operational environment. It includes pay and related costs for civilian employees, travel, transportation, rent, communications, and utilities costs and procurement of supplies. This project supports and complements all of the projects in this program element.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable.

(2) (U) FY 1985 Program: Not applicable.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Not applicable.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62203F — Title: Aerospace Propulsion
DOD Mission Area: #523 - Engineering Technology (ED) — Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	56,216	58,088	62,609	70,797	Continuing	N/A
06PP	Laboratory Operations	18,544	18,554	18,868	19,860		
3012	Ramjet Technology	6,700	7,300	8,300	9,900		
3048	Fuels, Lubes & Fire Protection	8,231	7,936	8,525	9,185		
3066	Turbine Engine Technology	14,818	15,794	16,616	20,244		
3145	Aerospace Power Technology	7,923	8,504	10,300	11,608		

*Excludes January 1985 Civilian Payraise (725)

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element develops propulsion and power technology in support of current and future aerospace vehicles and weapons systems. Exploratory development and component/subsystem evaluations are conducted in the technical areas of turbine engines, ramjet engines, fuels, lubrication, and fire protection technology as well as aerospace power generation, distribution and control technology. The program also provides for the management and support of the Aero Propulsion Laboratory at Wright-Patterson Air Force Base, OH. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	55,893	60,445	63,808		Continuing	N/A

Difference in FY 85 funds is due to congressional reduction.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Military Construction: Funds	0	3,050	1,950	0	N/A	N/A

5. (U) RELATED ACTIVITIES: This program receives information and technology from PE 61102F, Defense Research Sciences. It interacts with other exploratory development program elements and feeds PE 63202F, Aircraft Propulsion Subsystem Integration; PE 63211F, Aerospace Structural Materials; PE 63215F, Aviation Turbine Fuels Technology; PE 63216F, Advanced Turbine Engine Gas Generator; PE 63217F, Weapon Systems Power; and others. Coordination with Army, Navy, National Aeronautics and Space Administration (NASA), Department of Energy, Department of Transportation, Environmental Protection Agency, industry and academia is accomplished by joint projects, information exchanges and standing committees, such as the Interagency Advanced Power Group, the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee, and the NASA/Air Force semiannual meetings.

6. (U) WORK PERFORMED BY: Work is managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Other Air Force organizations involved are the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH; the Space Division, Los Angeles, CA; and Armament Division, Eglin Air Force Base, FL. The five major contractors for the program in FY 1984 were: General Electric, Evendale, OH and Lynn, MA (all projects); United Technologies, East Hartford, CT, West Palm Beach, FL and San Jose, CA (Projects 3066, 3012, 3048); McDonnell-Douglas Aircraft, St Louis, MO (Projects 3066, 3012, 3145); Garrett Corp, Los Angeles, CA and Phoenix, AZ (Projects 3066, 3048); and Boeing Co., Seattle, WA (Projects 3012, 3048, 3145). There are 70 additional contractors working on 70 contracts worth $66,000,000.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3012, Ramjet Technology. This project develops ramjet component and engine technology to improve performance and reduce costs of tactical and strategic air-launched missiles. Ramjet propulsion concepts being evaluated include: variable fuel flow ducted rockets (VFDR) for tactical air-to-air missiles, solid fuel ramjets, and high payoff components for liquid fuel ramjets for long range air-to-surface missiles. These efforts include component development of inlets, gas generators, combustors, nozzles, fuel controls, and engine technology demonstrators. Emphasis is on solid fueled ducted rockets for tactical air-to-air applications and liquid fuel ramjets for air-to-surface application. FY 1984 Accomplishments - Tests demonstrated that the radar cross-section of a ramjet powered missile is comparable to a solid rocket powered missile. A retainable port cover plug was developed that significantly reduces combustor pressure oscillations. Ducted rocket gas generator fuels were developed that increase energy density by 30 percent. A fuel flow throttling capability of 8.5 to 1 was demonstrated. The feasibility of a consumable port cover concept was proven. For the solid fuel ramjet, an analysis showed that controlling the air flow during a mission can increase range up to 50 percent. Demonstrated on-command concepts to alter engine thrust. Analysis showed that boron fuel can increase range up to 80 percent. FY 1985 Program - An effort will be initiated to further develop boron combustion technology and another initiated to demonstrate a highly efficient, short combustor. Competing variable flow ducted rocket engine concepts will be demonstrated in ground test. Debris free engine inlet cover and port cover concepts will be demonstrated. An advanced nozzleless booster will be tested over a temperature range of -65°F to 145°F. The application of advanced materials to ramjet structures will be investigated. A solid fuel ramjet with hydrocarbon fuel will complete environmental testing. The use of ammonium perchlorate additive to extend high altitude capability

will be investigated. The combustion efficiency of boron fuels will be increased through formulation optimization. FY 1986 Program - Various engine component programs will be integrated and a liquid boron slurry engine demonstration program initiated. Advanced swirl combustion concepts will be demonstrated. Short combustor durability and performance will be demonstrated. High speed ramjet technology efforts will be initiated. A joint United States/German boron ducted rocket effort will be initiated. Efforts to integrate the ducted rocket with aero-configured missiles will be expanded. High altitude combustion will be addressed with an advanced ducted rocket gas generator. Fabrication and demonstration of ramjet structures using lightweight advanced materials will be initiated. Solid fueled ramjet boost-to-sustain transition with hydrocarbon fuel will be demonstrated. The selection of a boron fuel for an engine demonstration will be made. Air induction system performance analysis will be completed. Ammonium perchlorate additive will be incorporated into boron fuels to extend altitude capability. Air turboramjet development will be initiated.

B. (U) Project: 3048, Aerospace Propulsion Fuels, Lubrication and Fire Protection. The purpose of this project is to provide: (a) fuels and the understanding of fuel/system effects required to support present and future air-breathing engine powered weapon systems, (b) lubricants, lubrication techniques, condition monitoring techniques, and lubrication system components (bearings, seals, dampers) to satisfy the stringent requirements of future aerospace weapon systems, and (c) advanced fire and explosion hazard characterization methodology, fire prevention and containment measures, hazard detection, and active and passive protection systems to satisfy flight vehicle combat survivability and operational safety requirements. Additionally, it supports other Air Force commands in resolving field problems and coordinates and controls the research, development, test, and evaluation of Air Force fuels, lubricants, and associated specialty products for air-breathing propulsion and power systems as specified by appropriate regulations. Coordination with and participation in joint programs with Army, Navy, NASA, FAA, and other government agencies and a close working relationship with industry and other nations is pursued. The project is divided into five major emphasis areas: aviation fuels, missile fuels, lubricants, bearings, and fire protection. FY 1984 Accomplishments - Chemical and physical properties characterization of shale derived JP-4 fuel to complement PE 63215F fuel performance testing was completed and resulted in transition of shale JP-4 to the Operational Validation Phase. A carbon slurry fuel, designate SF-2, has been developed which shows good stability and flow properties while offering range increases up 16 percent over JP-10 for cruise missile applications. Brassboard feasibility of a Portable Wear Metal Analyzer (PWMA) which can be packaged for rugged field use while providing simple operation and nine-element oil analysis compatible with existing analysis was demonstrated. The PWMA program is responsive to a high priority logistics need. In the bearings area, a material increasing fracture toughness by a factor of 2.5 was developed and demonstrated in a current Joint Technology Demonstrator Engine. This advancement will increase bearing operational capability by 20 percent as well as provide more reliable bearings for future engines. In the aircraft fire protection area, two prototype air separation techniques (molecular sieve and permeable membrane) were thoroughly evaluated in a simulated aircraft operational environment. These air separator units are the major elements of On-Board Inert Gas Generation Systems (OBIGGS) for transport aircraft fuel tank inerting. This technology is intended to be transitioned to future transport aircraft under the Weapon System Support Development program element. In-house chemical laboratory and other test cell operations were reestablished in the new Fuels and Lubrication Laboratory facility. FY 1985 Program - NATO and AFCC Fuels and Lubricants

Standardization activities and Air Force regulation 80-35 support requirements will continue to be fulfilled. Alternative aviation fuels technology efforts will be placing major emphasis on characterizing properties of a broad specification fuel capable of manufacture from petroleum crude as well as shale, tar sands, heavy oils, and coal liquid resources. The broad spec fuel will maximize fuel availability while preserving performance and minimizing cost factors Feasibility of a high density aviation fuel offering up to 15 percent range improvement over conventional JP-4 will also be determined. Missile fuel technology will begin to focus on aluminum and aluminum-carbon slurry fuels offering 50 percent improved energy content over current JP-10 hydrocarbon missile fuel. Transition of the Portable Wear Metal Analyzer to Logistics Command for field implementation is planned. In addition to coordination of joint technical development activities on improved bearing materials, seals, and counter-rotating bearings with the Navy, solid lubricated rolling element bearing technology for advanced, limited life, small turbine engines will be initiated. The goal will be to develop bearings capable of operating at temperatures up to 1500°F at high speeds. Fire protection technology will focus on establishing design criteria for the Tactical Inert Gas Generator System (TIGGS) for transition to the Advanced Technology Fighter via an FY 1987 new start advanced development program. Fuel system electrostatic hazards evaluation of conductive explosion suppression foam candidates developed by the Materials Laboratory and gunfire testing of advanced dry bay fire protection systems are planned. FY 1986 Program - No new starts are planned in the aviation turbine fuels area. Operational commands and international standardization support requirements will be met. Broad spec/multi-source fuel development, including the high density turbine fuel initiative, will be continued. Emphasis will be on maximizing availability while preserving performance at reasonable cost/gal. Metal slurry fuels development and related fuels system design criteria for cruise missiles will be continued. Development of an improved boron solid fuel for use in a tactical solid fueled ramjet will be initiated. Development of -60°F to 400°F lubricant to meet advanced turbine engine performance demands should be completed. Investigation of on-board turbine engine lubrication system wear monitor will begin. Technology advancements in high speed liquid/lubricated bearings and solid lubricated bearings will be continued toward fulfilling more stringent turbine engine powered aircraft and cruise missile performance requirements. Design and development of solid lubricated gears for use in limited life turbine engines and advanced foil bearings for high power density auxiliary power units will be initiated. A/C fire safety technology will continue to focus on electrostatic hazards, finalization of tactical inerting preliminary design studies, and dry bay fire protection systems and engine bay fire hardening tests. No new starts are currently planned.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3066, Turbine Engine Technology

A. (U) Project Description: The purpose of this project is to conduct exploratory development on advanced turbine engine component technologies to provide superior turbopropulsion systems for future Air Force missions. This project develops technology to increase propulsion system operational reliability, cycle flexibility, and performance while reducing fuel consumption, weight, and acquisition and operational support costs. Both analytical and experimental efforts are conducted in fans and compressors, high temperature combustors, turbines and seals, controls,

diagnostics, exhaust systems, and structural design techniques. This project considers the total propulsion system (inlet, engine, nozzle) and its integration into a weapon system.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The first aerodynamic test, using a J85 compression system, was successfully accomplished in the Compressor Research Facility (CRF). Over 250 data points were taken for which measurements and calculated results were reproducible within one percent and the drive system proved capable of stable operation up to speeds required for the next three test articles. Relative to recent advancements in compressor aerodynamics, a new 3D swept shock design system (developed in-house) permits blade shape tailoring to accommodate and minimize shocks and shock losses in the supersonic portion of axial flow compressors. This advanced design concept will permit a substantial increase in tip-speed and, hence, stage work capacity. In the hot section area, turbine heat transfer measurements taken on both cooled and uncooled airfoils in both shock-tunnel gas-path simulators and actual engine environments have now made it possible to accurately define gas-to-metal heat transfer conditions over the entire airfoil surface. These test results will revolutionize existing turbine heat transfer design codes and provide for more accurate and reliable prediction of airfoil thermal gradients and cooling requirements. In the missile engine technology area, a modified cruise missile combustor successfully demonstrated a 95 percent combustion efficiency level using carbon-slurry fuels thus demonstrating the potential for realizing the increased range capability offered by this high density fuel in future missile propulsion systems.

(2) (U) FY 1985 Program: During FY 1985, principal emphasis will be centered on two major initiatives: (1) implementation of the Integrated Technology Plan for the 1990s (ITP-90) to include initiation of the innovative structures and combustion system development activity; and (2) formulation of limited-life engine component developments in support of the new advanced development initiative also planned for FY 1985 in Program Element 63202, Advanced Propulsion Subsystem Integration. Accomplishments expected to be realized in FY 1985 include completion of the high tip speed compressor performance and structural characterization test and the F100 compressor mapping test in the CRF, and completion of the 2-stage compressor research test validating the new Wennerstrom compressor aerodynamic design system. Within the hot section area, work in Variable Cycle Engine Heat Transfer and variable-geometry turbine aerodynamics and heat transfer will be completed, the results of which will support the design system needs of the advanced turbines. Composite shaft design will be completed and composite materials applications to hot section structures and attachment areas will continue. The carbon slurry combustor performance demonstration and uncooled turbine vane designs applicable to missile engine systems will be completed and transitioned to the new advanced development initiative.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: During FY 1986, the foundation for all ITP-90 component development efforts, including Materials Laboratory support, will be in place in preparation for starting all ITP-90 full-scale component developments in FY 1987. With the completion of testing of the 2-stage compressor aerodynamic design system, the third stage design will be finalized and fabrication initiated. Additionally, work in high temperature composite materials applications, advanced high temperature small engine combustors and radial

turbines for missile propulsion systems, and research into advanced rotordynamics to long chord fan and compressor blading will be initiated. The overall approach of these integrated programs is to ensure that the individual programs are compatible and lead to an engine with a 100 percent improvement in thrust-to-weight over the Joint Advanced Fighter Engine for the Advanced Tactical Fighter. These technologies will challenge currently perceived techn[illegible] limits, will have primary relevance to important Air Force operational objectives for the turn of the century, [illegible] will be demonstrated, via experimental vehicles, across an engine design space that satisfies these important operational objectives.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3145, Aerospace Power Technology

A. (U) Project Description: This project includes the development of solar power, fuel cells, batteries, hydraulics and power conversion, conditioning and transmission as well as thermal management of these devices for both space and non-space applications. These analytical and experimental efforts form a balanced, broad base in power subsystem technology. General goals are increased power output, decreased weight and volume, decreased vulnerability, increased life and reliability, and increased tolerance to environments, to provide effective technology and capability options in conceptual phases of future systems.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The lithium aluminum disulfide thermal battery was qualified and transitioned to an advanced missile. Nickel-hydrogen batteries were selected for a military satellite. A 700°C silicon solar cell was demonstrated. A planar solar array successfully met a severe laser hardening requirement. A prototype nonflammable fluid hydraulic system was successfully tested at 8000 psi. The rotor for the 20MW superconductor generator was completed and tested. The qualification testing for a 60KVA starter/generator system for an A-10 was completed. Initial testing of a cascaded 400Hz generator system was completed. A high power spacecraft thermal management program was initiated.

(2) (U) FY 1985 Program: The survivability of solar concentrator systems to laser effects will be established. Two to three mil gallium arsenide solar cells will be fabricated. Lightweight high voltage solar array work will be initiated. Advanced thermal battery technology for tactical missiles will be transitioned to advanced development. The high power electron beam switch and 40KA - 40KV thyratron device fabrication will be completed.

An 85 hp electric fuel pump will be completed. The 5 megawatt permanent magnet generator fabrication will be completed. High power spacecraft thermal management and burst power thermal management studies and designs will be continued.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full load test of the 20MW superconducting generator will be completed and the 5MW generator test program initiated. The electron beam and thyratron switch test programs will be completed. A three terminal 22 percent efficient multi-bandgap solar cell will be demonstrated. Rechargeable lithium missile battery exploratory development will be transitioned to advanced development. A low profile hydraulic actuator program for thin wing aircraft will be initiated. Initial development of a hydrogen-oxygen gas generator and a turbine will be initiated. A foil bearing program for space turbo-machinery will be initiated. A thermionic conversion program for space application will be initiated.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06PP, Laboratory Operations

A. (U) Project Description: This project provides for the management and support of the Aero Propulsion Laboratory. The Laboratory develops propulsion and power technology in support of current and future aerospace vehicles and weapons systems. The project provides for the pay and related costs for civilian employees, travel, transportation, rents, communications and utilities costs, and procurement of supplies. This project supports and complements all of the projects in this program element.

B. (U) Program Accomplishments and Future Efforts: Not applicable.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62204F
DOD Mission Area: #521 - Electronics and Physical Sciences (ED)

Title: Aerospace Avionics
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		70,188	72,510	74,806	83,342	Continuing	N/A
06AA	Air Force Avionics Laboratory Operations	28,092	28,014	28,312	29,895		
2000	Active Electronic Countermeasures	4,572	4,450	4,600	5,200		
2001	Electro-Optical Technology	3,200	3,250	3,400	3,800		
2002	Microwave Technology	7,372	7,700	7,900	9,300		
2003	Avionics System Design Technology	4,640	4,950	5,294	6,047		
2004	Technology for Reconnaissance and Targeting Avionics	3,100	3,182	3,400	4,000		
6095	Inertial Reference and Guidance Technology	2,000	2,050	2,000	2,300		
6096	Microelectronics Technology	4,500	4,984	5,000	5,600		
7622	All-Weather Reconnaissance/ Strike Avionics	5,600	6,300	6,900	8,100		
7629	Fire Control Avionics	2,694	2,750	2,900	3,300		
7633	Passive Electronic Counter-measures	3,443	3,880	4,000	4,500		
7662	Avionics Data Transmission and Reception	975	1,000	1,100	1,300		

* Excludes January 1985 civilian pay raise ($1,145).

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is a Science and Technology effort and is the primary source of new concepts, feasibility demonstrations, and technology evaluation for the full spectrum of Air

Force avionics system needs. Mission areas addressed include target detection and classification, fire control, navigation, communication, jamming and deception of hostile defenses, core avionics system design and avionics subsystem integration technology and the crucial supporting technology of electronic devices and circuits. Avionic advances have the potential to multiply weapon system effectiveness. Modern technology has also begun to yield enhanced reliability and reduced life cycle costs. The program also supports the management and support of the Avionics Laboratory, Wright-Patterson Air Force Base, OH.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	69,613	72,510	80,394		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987
Military Construction Funds	600	0	0	0

5. (U) RELATED ACTIVITIES: Since this program is a broad technology base effort, technology transfer takes place between a large number of related program elements. The most significant of these, to or from which a significant number of efforts are transitioned, include: Defense Research Sciences, 61101E; Defense Research Sciences, 61102F; Materials 62102F; Strategic Technology, 62301E; Command, Control, and Communications, 62702F; Advanced Avionics for Aircraft, 63203F; Reconnaissance Sensors/Processing Technology, 63208F; Very High Speed Integrated Circuits, 63452F; Electronic Warfare Technology, 63718F; Advanced Communications Technology, 63727F; Combat Identification Technology, 63742F; Electro-Optical Warfare, 63743F; Counter-Countermeasures Advanced Development, 63750F; and Advanced System Integration Demonstration, 63253F. Tri-service and interagency coordination is continually accomplished. All electron device work is coordinated through the Advisory Group on Electron Devices which advises the Office of the Undersecretary of Defense for Research and Engineering. All work on fiber optics components and systems applications is coordinated through the Tri-Service Fiber Optics Coordinating Group. Developments in thermal imaging and image processing are coordinated through the Night Vision Technology Panel under the Joint Deputies for Laboratories Committee which, in turn, is under the Joint Logistic Commanders. Many areas of work are coordinated through the Air Force/National Aeronautics and Space Administration Interdependency Working Groups on Space and Aeronautics. Radiation hardening activities are coordinated through the Radiation Hardened Electronics Technology Coordinating Group. Work on flares and related devices is coordinated through the Tri-Service Pyrotechnics Coordinating Group. Infrared sensor developments are coordinated through the Joint Technical Coordinating Group on Thermal Imaging Sensors. Sensitive technology developments are coordinated through the Joint Technical Coordinating Committee (COCOM) to prevent disclosure to hostile nations. The Laboratory participates in a Joint Air Force/Navy Radar Working Group, a Tri-Service Airborne Displays Working Group, and a Tri-Service Background and Targeting agreement originated by the Air Force

Armament Laboratory. In the area of standardization, the laboratory is active in the Bubble Memory Standardization Subcommittee of the Joint Electronic Devices Engineering Council, and in national standards activities coordinated by the Society of Automotive Engineers, especially in the area of aircraft data multiplexing systems. This extensive coordination activity ensures timely dissemination of progress to qualified parties and avoids wasteful duplication of efforts. Key program elements involved in this coordination include: Aircraft Avionics, 62202A; Electronic and Electron Devices, 62705A; Aircraft Avionics Equipment, 63702A; Night Vision Investigations, 62709A; Night Vision Advanced Development, 63710A; Electron Device Technology, 62762N; Avionics, 63203N; and Countermeasures Technology, 62734N.

6. (U) WORK PERFORMED BY: The Avionics Laboratory, Wright-Patterson Air Force Base, OH manages the work performed under this program. The five major contractors are: Texas Instruments, Dallas, TX (2002, 2004, 6096, 7662); Hughes Aircraft Company, El Segundo, CA (2000, 2001, 2002, 2003, 6096, 7629, 7633); TRW, Redondo Beach, CA (2001, 2002, 2003, 6096); Western Electric, Murray Hill, NJ (2003, 6096); and Raytheon Corporation, Bedford, MA (2002, 7622). The total number of additional contractors was 64. The total dollar value for these contractors was $96M.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2000, Active Electronic Countermeasures. The rapid growth of sophisticated enemy threats operating in ever expanding portions of the electromagnetic spectrum requires the development of new techniques and capabilities to insure the ability of our aircraft to penetrate enemy defenses, accomplish the mission, and survive. This project addresses this need

Both radio frequency and optical/infrared threat systems are addressed.

FY 1984 Accomplishments: During FY 1984 the Small Platform EW (SPEW) Program designed an expendable electronic countermeasures (ECM) system.

A pyrotechnically pumped expendable laser jammer has been fabricated and evaluated in a laboratory environment.

A low band (low frequency) electronic countermeasures (ECM) airborne antenna has been designed operating over the 6-30 Megahertz frequency band. FY 1985 Program:

A gallium arsenide monolithic microwave integrated circuit amplifier will be designed, fabricated, and tested as the first step in the design and evaluation of a solid state amplifier/phased array self-protection jammer. FY 1986 Planned Program:

A

seven element linear jamming array will be fabricated and tested, using solid state monolithic microwave integrated circuits. The first millimeter wave solid state jammer array will be demonstrated for the purpose of proving feasibility. Studies started for a comprehensive analysis of electronic warfare needs for aircraft having reduced observable levels will be completed. Critical technologies will have been identified and programs to reduce technical risks in these areas will be initiated.

B. (U) Project: 2001, Electro-Optical Technology. This project develops lasers, detectors, and optical signal processing components for a wide range of functions in offensive and defensive avionic systems. Work includes development of broad bandwidth tunable lasers for search and countermeasures; advanced infrared detector arrays and signal processing for detection and imaging; lasers and detectors for laser radars; and optical components for threat warning spectral analysis, correlation tracking, and fiber optic sensors. This basic component development leads to enhanced performance, increased reliability, and reduced size and cost for a large range of applications. FY 1984 Accomplishments: New solid state laser materials have been grown and tested which substantially increased laser operating efficiency and increased wavelength ability to substantially reduce size and increase operational performance for countermeasure systems. A high speed spatial light modulator has been demonstrated to enable real time image correlation tracking in missiles. The first viable material growth methods have been established for a solid state ultra violet detector for electronic warfare solar blind detection and satellite horizon sensing application. Thermo-electric cooled laser radar detector arrays have been demonstrated for high reliability, long operating time sensors in cruise missiles. A high, dynamic range acousto-optic spectrum analyzer has been demonstrated for a very high-threat-signal-density, radar warning receiver. FY 1985 Program: Demonstration of a phase conjugation concept enabling use of a single laser to accomplish the multiple functions of bore sight, search, and countermeasures to enable reduced size and weight of electronic warfare systems will be accomplished. A tunable solid state laser that enables full 1.8-5.0 micron wavelength coverage as a small, hardened electronic warfare source for countermeasures to heat seeking missiles will be demonstrated. A new detector structure that increases quantum efficiency and reduces observability will be demonstrated. High, dynamic range, on-focal-plane signal processing circuits for increased performance of thermal imaging systems will be verified in thermal imaging demonstrations. FY 1986 Planned Program: Medium energy laser technology will continue to be developed for in-band sensor killing to enable a countermeasure to multiple threats in a time line compatible with tactical and strategic aircraft survivability. Ultra-high speed signal processing components to enable real time signal processing of sensor data will continue to be developed by demonstrating vector-matrix processor architectures, high performance laser diode and fiber optic sources, a 1000x1000 liquid crystal light valve, and broad-band high diffraction efficiency Bragg Cells. High operating temperature extrinsic detector materials will be demonstrated to provide longer operating life, thereby resulting in a more reliable thermal imaging systems.

C. (U) Project: 2002, Microwave Technology. This project develops the technology required to produce, control, and apply microwave and millimeter wave power. The scope of efforts includes theory, techniques, devices, and concepts at frequencies below 300 Gigahertz (GHz). Areas of development are solid state sources and amplifiers, thermionic devices, power sensing and control, and phased array antenna techniques. System uses for this technology include radar, electronic countermeasures, and communications. This technology development will increase reliability and performance,

and reduce size and cost of components vital to a variety of microwave and millimeter wave systems. FY 1984 Accomplishments: A pulsed gallium arsenide impact avalanche and transmit time (IMPATT) amplifier using power combining at the circuit level was demonstrated to support seekers for missiles. Monolithic gallium arsenide circuit technology was demonstrated with a single chip X-band transmit/receive module, switches, phase shifters and a power and low noise multistage amplifier which was previously developed in hybrid form for tactical phased array radars. This monolithic technology is key to achieving low cost and the high reliability needed to make such systems as the Ultra Reliable Radar affordable. A 20-40 Gigahertz (GHz) millimeter wave helix power tube for electron countermeasures transmitters was demonstrated. Ceramics used in power tube design and fabrication have been characterized at millimeter wave frequencies. A 4.5-18 GHz electronic countermeasures (ECM)/radar antenna aperture demonstration was aimed at the development of a broadband multifunction antenna to assist in reducing aircraft radar cross section. Further improvements in gallium arsenide microwave device technology were achieved through demonstration of improved efficiency and higher power levels for application to compact radar, communications and countermeasures systems. FY 1985 Program: Traveling Wave Tube (TWT) amplifier development will continue in the 20-40 and 40-60 GHz frequency band, with new efforts on high power isolators and instrumentation as a way to enhance TWT reliability. Work will continue to demonstrate improved power generation and amplification from millimeter wave transistors. New programs will be initiated to develop pulsed gallium arsenide field effect transistors and low noise transistors up to 100 GHz. A 94 GHz integrated transceiver for low cost millimeter wave communications will be demonstrated. A design study of counter-countermeasures for a 2000 element active aperture phased array radar will be completed and will furnish vital data to the design of the Ultra Reliable Radar Advanced Development effort. FY 1986 Planned Program: A 20-40 GHz 100 watt helix traveling wave tube will be demonstrated with application for an electronic countermeasures system. Work will continue on the development of monolithic solid state radar transmit/receive modules. The goal is to demonstrate a more complex design than previously developed with the ultimate goal of making tactical phased array radars practical and affordable. Initiate program for the development of 94 GHz IMPATT power combiner and X-band field effect transistor power combiner. Continue development on 44 GHz field effect transistor and 60 GHz IMPATT transmitter development. Initiate program to demonstrate antenna feed networks for solid state aperture and for multifunction arrays.

D. (U) Project: 2003, Avionics System Design Technology. The objective of this project includes advanced methods of designing, integrating and validating avionics systems and the facilities to simulate and evaluate such systems. The increasing use of embedded computers has created urgent needs for software support, while the high cost of testing places a premium on simulation techniques. This work produces both short term payoffs through improved design and acquisition of avionics software and longer term results as the basis for future integrated systems. In both cases, there is direct return on investment in the form of reduced life cycle costs, improved reliability, and easier upgrading of avionics suites. FY 1984 Accomplishments: In FY 1984, several key avionics system architecture programs were completed and aimed at exploiting integrated avionics suites for increased mission effectiveness and availability. Integrated avionics system testing and maintenance concepts were developed employing such methods as analytical fault detection and isolation, in-flight failure diagnosis and fault data recording, and pre/post-flight operational testing to significantly increase the maintainability and availability of avionics and reduce mean-time-to-repair (MTTR). FY 1985 Program: An electronic terrain map integrated with overlayed threat information will be demonstrated in the laboratory. This technology is key to passive navigation and real time threat avoidance. A software environment to improve the programmability of digital signal processors will be demonstrated. The impact of this

program will significantly lower the life cycle costs for future signal processing software development. Efforts will continue to develop a second generation generic signal processor architecture for uniform use in radar, electronic warfare, image processing, and communications applications. This program will build on the Advanced Development Program for the Common Signal Processor. FY 1986 Planned Program: Planned efforts include a shifting emphasis toward application of artificial intelligence techniques to cockpit automation, pilot decision aids, and integrated diagnostics and maintenance. A panoramic cockpit control and display system will be demonstrated using high brightness, large area projection displays, helmetmounted sights, touch controls, and voice inputs. Conceptual definition and design of a second generation generic signal processor applicable to a wide range of avionics functions will be completed. The design will incorporate submicron very high speed integrated circuit technology.

E. (U) Project: 2004, Technology for Reconnaissance and Targeting Avionics. The objective of this project is to provide the basis for major advances in electro-optical and infrared systems for real-time reconnaissance, automated target classification and aircraft navigation and defense. Efforts include techniques for target pattern recognition, advanced sensors, and advanced forward looking infrared systems with higher resolution and multifunctions. This work is essential to support both tactical and strategic aircraft ability to cope with high target and defense densities and to achieve multiple kills per sortie against a numerically superior enemy. FY 1984 Accomplishments: Project highlights include a laboratory demonstration of the basic Multiband Staring Sensor 100x128 detector chip and Charged Coupled Device (CCD) set in both gallium and indium doped silicon. Critical design reviews of the multifunction forward looking infrared sensor were accomplished, with both Texas Instruments and Martin Marietta having acceptable designs. After the review, a down select was made and Texas Instruments was chosen to continue this program. The multiple function Carbon Dioxide (CO_2) Laser Sensor was demonstrated in the laboratory and moved to the field for field testing. The sensor has undergone debugging and data is being collected. FY 1985 Program: A high resolution staring (non-scanning) focal plane will be demonstrated in the laboratory in both the 3-5 and 8-12 micron bands. This effort will help to improve target tracking and identification at increased standoff ranges. Development will be initiated on a second generation CO_2 laser radar sensor to demonstrate a complete targeting capability with this technology, including multiple target acquisition, classification, and hand-off for fire control and weapons delivery. Work will continue on the multifunction forward looking infrared sensor project. A program will be initiated on a passive synthetic aperture sensor for greatly improved target discrimination capability. FY 1986 Planned Program: In FY 1986, a passive synthetic aperture infrared sensor will be demonstrated in the laboratory and will improve targeting and tracking performance. A high resolution staring sensor with large aperture will be demonstrated that operates over multiple infrared frequency bands for improved targeting and tracking. Work on the multifunction forward looking infrared sensor project will be completed.

F. (U) Project: 6095, Inertial Reference and Guidance Technology. The objectives of this project are to improve the accuracy of inertial navigation systems as needed for cruise missile and tactical strike weapons and to develop low cost, mass-produced components for high volume applications such as tactical missiles. The work includes ultra precision strapdown accelerometers and low cost laser gyros, techniques for inertial navigation gravity compensation, and integrated navigation system designs using artificial intelligence. This work is essential both to permit advanced strategic and tactical weapon systems to be built and to address the high cost of present moderate performance inertial navigation systems. FY 1984 Accomplishments: In FY 1984, demonstrated that the use of polymar plastics can reduce cost

of gyros by a factor of three. The fabrication of a high accuracy strapdown accelerometer was completed and evaluation initiated. This technology is crucial to a quick reaction, no warm-up time response capability for cruise missile and tactical aircraft applications. Identified changes to the Air Force Form, Fit, and Function Inertial Navigation Systems Specification to accommodate both gimbal and ring laser mechanization for integration compatability. FY 1985 Planned Program: Evaluation of the high accuracy strapdown accelerometers fabricated in FY 1984 will continue. Efforts will be completed on a program to develop and demonstrate, by flight testing, a gravity compensation algorithm to negate the gravity induced errors on inertial navigation systems. A program to investigate fast reaction low cost accelerometer and laser gyro techniques will be initiated to provide technological alternatives and a lower cost approach to high accuracy gyroscopes. The design and implementation of an adaptive tactical navigation system will be initiated with payoff in reduced pilot workload and increased mission accomplishment. FY 1986 Planned Program: Development will continue on a high accuracy strapdown accelerometer required for the 0.1 nautical mile per hour error ring laser gyroscope navigation system. Complete flight test demonstration on the gravity compensation algorithm and verify that this algorithm is ready for transition to current tactical and strategic aircraft. Efforts will continue on the development of an integrated fiber optic gyro for lower cost alternative to the high accuracy ring laser gyro. Efforts on development of an Adaptive Tactical Navigation System using artificial intelligence to reduce pilot workload will continue.

G. (U) Project 6096, Microelectronics Technology. This project exploits selected solid state device and circuit technologies to achieve advances in information processing capacity, reliability, and radiation hardness. Work includes both advanced devices and materials, such as large scale gallium arsenide integrated circuits, and basic problems of packaging, testing, and design techniques needed to reduce cost and improve reliability in existing technology. The project is structured to complement developments in industry and other government laboratories by pursuing high payoff technologies not supported elsewhere. System payoffs include ultra fast front end processors for real time surveillance systems; reduced size, weight, and cost of conventional microelectronic components; and tremendous expansion of data storage in avionics systems. FY 1984 Accomplishments: For ultra high speed signal processing, the area of gallium arsenide modulation doped field effect transistor (MODFET) heterojunction integrated circuit technology has achieved a divide by 2 function operating at 10 Gigahertz (GHZ) and the first time demonstration of a self-aligned gate MODFET structure. To fill the high speed packaging and testing technology gap, a 28 terminal 2-3 GHz leadless chip carrier and an eightpoint probe capable of performing on wafer digital testing at GHz rates have been developed. FY 1985 Program: The FY 85 program is consistent with the continued development of the technology base to meet the future high speed needs of avionics signal/data processing systems. These include high speed (Gigahertz range) gallium arsenide integrated circuits compatible with advanced microscan receivers, gallium arsenide one-thousand bit random access memories with an access time of 1 nanosecond, verification of the enhanced performance offered by modulation doped heterojunction transistor technology at the 10 Gigahertz (GHz) clock region and demonstration of production quality bismuth garnet magnetic bubble materials for mass memory application. FY 1986 Planned Program: The FY 1986 program will emphasize completion of high speed logic and memory efforts in the 2-3 GHz region leading to dedicated integrated circuits for Electronic Warfare applications; the initiation of subnanosecond four-thousand bit gallium arsenide random access memories; a high speed, 4-6 bit analog to digital converter with sampling rate of 1-2 gigasamples per second; and appropriate computer aided design tools to support the overall technology transition to the application areas of signal processing for electronic warfare, radar and communications. This plan will be further supported by

the expansion of the gallium aluminum arsenide modulation doped field effect transistor area to focus on dedicated integrated circuit functions to meet the signal processing needs of the late 1990s.

H. (U) Project: 7622, All-Weather Reconnaissance/Strike Avionics. The objective of this project is to develop new radar techniques to improve in weather target acquisition, survivability, and system availability of aerospace-borne weapon systems. The work addresses the urgent need to extend tactical and strategic mission capability for night/all-weather conditions in severe, high threat environments. Techniques being developed include bistatic/monostatic ultra-high resolution synthetic array radar and automatic target screening/classification for improved acquisition of small tactical targets, improved low probability of intercept and electronic counter-countermeasure approaches for improved aircraft penetration capability and resistance to severe enemy jamming threats, and counter low observables concepts to maintain acquisition capability against reduced cross-section enemy aircraft. FY 1984 Accomplishments: Additional data was collected to extend the data base for the bistatic Synthetic Array Radar (SAR) project in order to improve understanding of the ineraction of tactical and background ground clutter under varying bistatic imaging angles. This effort provides the baseline information necessary to develop a passive concept, all-weather strike capability. Successfully completed an interim milestone critical to future application of ultra-high resolution SAR in maneuvering tactical fighter aircraft by laboratory feasibility demonstration of practical auto-focus technique for compensation of residual motion and phase errors. Completed concept definition and transitioned to advanced development for an adaptive, agile radar approach for future frequency and waveform agile electronic countermeasures resistant radars. FY 1985 Program: In FY 1985, improved processing techniques, such as doppler processing and autoregression, will be demonstrated with the synthetic aperture radar for improved classification performance and hardware bandwidth requirements. These techniques will allow successful air-to-ground operation with less demanding performance in a jamming environment. The vulnerability to hostile detection of these waveforms will also be determined. A conceptual design of a countermeasures resistant radar will be completed; it provides the frequency and and waveform agility to adapt in real time to the threat environment. A major thrust to study passive air-to-air radar concepts with conformal antennas will be initiated to provide longer range threat detection, passive operation, and improved situational awareness. The Space Shuttle bistatic imaging radar experiment to demonstrate technical compatability of exploiting space illuminator assets for covert, passive aircraft imaging of surface targets will be completed. FY 1986 Planned Program: Complete ground demonstration of automatic technique for rapidly screening small, military significant target groups from broad area, high resolution SAR images. Continue and expand scope of investigations to develop active/passive techniques for detection of low observable enemy aircraft; initiate fabrication of breadboard hardware for ground based experiments. Perform flight test to demonstrate accurate bistatic targeting accuracy. Initiate fabrication of equipment for air-to-tower experiment to extend covert bistatic SAR imaging capability to ultra-high resolution. Using results of previously developed segmentation techniques investigations, and ultra-high resolution SAR data base, initiate development of automatic target classification algorithms compatible with advanced fighter applications.

I. Project: 7629, Fire Control Avionics. This project develops fire control technology which improves weapon delivery by integration of detection and tracking sensors with automatic weapon control systems and by developing enhanced fire control algorithms and munition management methods. Specific goals include better understanding of advanced sensor design concepts aimed at wideband apertures to support low observable airframes and integrated sensor

signal processors, wider usage of artificial intelligence techniques for fire control applications, modeling and simulation to study hardware and software design issues, and feasibility demonstration of advanced fire control concepts. Mission payoffs include higher weapons kill probability, multiple target attack, and improved survivability through firing range extension and evasive maneuvers. FY 1984 Accomplishments: Man-in-the-loop simulations were conducted to assess impact of advanced fire control algorithms on aiding pilot decisions in a high threat airborne multiple target environment. A digital simulation of the defense suppression fire control system was conducted which resulted in a specification for sensor threat location requirements to support fire control timeliness and an assessment of a dynamic route replanning algorithm for survivable penetration. Roofhouse experiments were conducted to show a fire control hardware interface to the Have Wedge dual mode guidance unit developed by the Armament Division. Requirements for self defense of a spaceborne laser platform were completed and transferred via the Space Division to all space laser concept development contractors. Preliminary algorithms developed in-house for air-to-ground multiple target were released to industry via formal technical reports. FY 1985 Program: The project will continue to develop new techniques for delivery of air-to-air and air-to-ground munitions through integration of sensors, new fire control algorithms and automation; and pursue efforts in penetration options and multiple target weapon delivery. Air battle management concept definition studies with recommendation on a resource manager concept, will be completed. A limited demonstration of artificial intelligence utility as applied to a subset of fire control functions, will be completed. The multiple target attack preliminary design for an advanced development for implementation and demonstration will be transitioned.

r In-house research of .equential target attack algorithms to ensure that they are operationally feasible in terms of executive time, memory, and hardware/software architecture will continue. FY 1986 Planned Program: A major effort will be undertaken to evolve a design for an integrated offensive/defensive fire control sensor suite. The concepts employed will utilize solid state aperture array and staring infrared array concepts to develop a wideband active/passive aperture and a combined infrared and radar signal processor/data processor design using very high speed integrated circuit (VHSIC) technology. A measurement program will be established to capitalize on industry investments in the radar cross section areas allowing development of a realizable data base to specify future sensor requirements. Application efforts are planned for continued exploitation of artificial intelligence as used within fire control systems and initiation of avionics guidance functions for a new generation of standoff weapons such as boost glide vehicles. In-house algorithm development and evaluation capability will begin to undergo a transition by applying aircraft systems technology to space and transatmospheric vehicles.

J. Project: 7633, Passive Electronic Countermeasures. The objective of this project is to increase aircraft survivability

These efforts are essential to allow both tactical and strategic aircraft to penetrate and survive dense, sophisticated hostile defenses. FY 1984 Accomplishments:

FY 1985 Program:

FY 1986 Planned Program:

K. (U) Project: 7662, Avionics Data Transmission and Reception. The objectives of this project are to develop improved methods to transmit information to, from, and between aircraft with high integrity, low probability of hostile interception, and resistance to jamming and false transmission, along with small size and high reliability. Such links are vital for operations control, weapon guidance, and reconnaissance data transmission. The project includes technical efforts which incorporate artificial intelligence into adaptive signal processors for communication, radar, and electronic warfare signals; develops modems for improved acquisition/reacquisition of wideband spread spectrum signals; develops laser communications; and develops optical signal processing to support these modems and receivers. This work is vital to provide battle commanders with needed intelligence in near-real-time, and to provide aircraft the ability to communicate in the presence of sophisticated enemy jamming. FY 1984 Accomplishments: Development efforts were continued on a programmable transversal filter using gallium arsenide charge coupled devices which will be a key to implementing jam resistant communication links. Adaptive interference suppression techniques were demonstrated that provide increased jammer immunity in all anti-jam communication systems. A wideband modem was developed and demonstrated jam resistant/low probability of detection transmission of data in a reconnaissance environment. FY 1985 Program: Work will continue on the optical communciations test bed and technology thrust. Study of laser communication links for tightly covert, jam resistant air-to-air applications will be completed. A program will be initiated to develop a wideband spread spectrum modem using advanced analog components with emphasis on decreasing acquisition times. A program will be initiated to develop adaptive signal processors for communication, radar, and electronic warfare transmissions that incorporate artificial intelligence into the adaptive algorithms. These efforts will improve physical survivability of airborne platforms by allowing covert/uninterrupted communications. FY 1986 Planned Program: Work will continue on the laser communication flying test bed. Artificial intelligence efforts will be blended into two on-going programs; the adaptive signal masking and the adaptive communication/radar/electronic warfare waveform processor. These efforts will improve the physical survivability of airborne platforms by providing low probability of intercept/jam resistant/covert transmission of voice/wideband sensor imagery data in a hostile

electromagnetic threat environment.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06AA, Air Force Avionics Laboratory Operations

A. (U) Project Description: This project provides for the management and support of the Avionics Laboratory, Wright-Patterson Air Force Base OH. The Avionics Laboratory is responsible for research, exploratory and advanced development programs concerned with navigation and guidance, weapon delivery and fire control, reconnaissance and aerospace surveillance, aerospaceborne communications, electronic countermeasures, avionics systems architecture and integration, and electronic and electro-optical device technology. The laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. This project provides for the pay and related cost of civilian scientists, engineers, and support personnel; transportation of equipment; rental equipment; communications and utilities cost; procurement of supplies and equipment; duplication and reproduction services; and contractor support services for maintenance and modification of facilities. This project supports and complements all other projects in this program element.

B. (U) Program Accomplishments and Future Efforts: Not Applicable.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62205F Title: Training and Simulation Technology
DOD Mission Area: #522 - Environmental and Life Sciences (ATD) Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		22,632	23,040	25,236	28,730	Continuing	N/A
06HT	Laboratory Support	6,608	6,773	6,817	7,135		
1121	Technical Training Development	2,698	1,770	2,041	2,343		
1123	Flying Training Development	1,797	2,910	3,507	3,430		
1192	Advanced Simulation for Pilot Training	5,941	5,167	5,783	6,640		
1710	Logistics and Maintenance Technology	3,958	3,978	4,802	5,672		
3017	Command and Control Training	**	999	978	1,253		
6114	Flight Simulator Technology	1,630	1,443	1,308	2,257		

* Excludes January 1985 civilian pay raise (221)
** Previously funded under Project 1121

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This science and technology program will improve operational readiness through more effective training and increased weapon system supportability. A major R&D area concerning flight simulation uses the Advanced Simulator for Pilot Training (ASPT), a wide field-of-view (FOV) visual flight simulator. The simulator and related devices are used to conduct research to develop innovative methods for flight simulator training, define simulator training effectiveness requirements, and develop innovative techniques for training tactics for air-to-ground and air-to-air combat. Another R&D area investigates techniques for enhancing maintenance and technical training by developing and evaluating computer based instructional technologies and maintenance training simulators for use in lower cost more effective technical training. A third major R&D area addresses the logistics support of weapon systems and improvements that can be made by specifying the interactions between the human elements of the logistics and maintenance systems, and the associated characteristics of weapon systems.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	22,477	23,240	27,105		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The majority of the work is directly in support of requirements identified by major commands, Air Staff agencies, and separate operating agencies. Related efforts of the military services are identified in the DOD Education and Training, Simulation and Training Devices, and Human Factors Technology Area Descriptions. Related program elements are: 61102F, Defense Research Sciences; 62202F, Aerospace Biotechnology; 63106F, Logistics Systems Technology; 63227F, Advanced Simulator Technology; 63751F, Training Systems Technology; 64227F, Flight Simulator Development; 62757N, Human Factors and Simulation Technology; 63733N, Training Devices Technology; 63720N, Education and Training, 62722A, Manpower, Personnel, and Training; 62727A, Non-System Training Devices Technology; and 63216A, Synthetic Flight Simulators. The laboratory has several formal agreements that specify support to be provided by the Air Force Human Resources Laboratory (AFHRL) and other agencies. These include agreements with: the Army Program Manager for Training Devices for visual display light valve projector and advanced computer image generation technology development; Tactical Air Command for flying training R&D and flight training schedules using the Instructional Support Software (ISS) system, Aeronautical Systems Division to coordinate simulator R&D with the Simulator Program Office and the Engineering Support Division; the Army and Navy to share development of a computerized instruction system; and with the Air Force Aerospace Medical Research Laboratory and Rome Air Development Center to share R&D products related to command and control systems. The Navy has a liaison office with AFHRL at Williams AFB, AZ. In addition, personal contacts, meetings, and formal contacts such as the DOD Technical Advisory Groups provide coordination between specific focal points for R&D efforts. Close coordination within the Air Force user community is also insured by annual coordination meetings between AFHRL, the Aeronautical Systems Division, and the major commands.

6. (U) WORK PERFORMED BY: The program is managed by the Air Force Human Resources Laboratory (AFHRL), Brooks AFB, TX. Three Laboratory divisions support the program element: Logistics and Human Factors Division, Wright-Patterson AFB, OH, Operations Training Division, Williams AFB, AZ, and Training Systems Division, Lowry AFB, CO. The Logistics and Human Factors Division is collocated with the Air Force Logistics Command, the Simulator Systems Program Office, and numerous other Air Force Laboratories and System Program Offices at Wright-Patterson AFB, OH. The Training Systems Division is collocated with the Air Training Command Technical Training Center at Lowry AFB, CO. The Operations Training Division is collocated with Air Training Command and Tactical Air Command pilot training operations at Williams AFB, AZ. The Operations Training Division also has convenient access to Tactical Air Command pilot training at Luke AFB and Davis Monthan AFB, AZ. The major contract efforts in FY 1984 were conducted by the following companies: Singer Company, Binghamton, NY (Project 1192); General Electric, Daytona Beach, FL (Project 1192); University of Dayton, Dayton OH; Universal Energy Systems, Chicago, IL (Project 3017); and Gould Sel Computer Systems, Ft Lauderdale, FL (Project 1192). The remaining FY 1984 contract program involved 42 additional contractors funded for a total of $14.5 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 06HT, Laboratory Support. This project provides for part of the management and support of the Air Force Human Resources Laboratory (AFHRL), including pay and related costs of civilian scientists and support

personnel, travel, transportation, rent, communications, maintenance, procurement of supplies and equipment, and contractor support services. The R&D operations supported by Project 06HT concern flying training and flight simulation, technical training, command and control training, and logistics and maintenance systems technology development. PE 62703F provides the remainder of the support for AFHRL's exploratory developments. This project supports and complements all projects in this program element.

B. (U) Project: 1121, Technical Training Development. Enhancements in instructional strategies and training delivery will result in improved methods for individual skills training that are both job relevant and cost effective. Primary areas of interest are computer-based and computer-managed training, training requirements definitions, artificial intelligence for maintenance aiding and training, and skills assessment. In FY 1984, development of Instructional Support Software (ISS), an enhancement of the Advanced Instructional System (AIS), was completed. ISS is a modularized software, written in the Ada language, which is transportable to mini- and micro-computers. Initial steps were taken to identify software for an expert system to be used in maintenance aiding and training. Arrangements were made to participate in an intelligent computer-assisted instructional (ICAI) network. Work on the maintenance simulation project was completed. Use of the maintenance simulators resulted in quality training and reduced training costs. In FY 1985, an operational test and evaluation of ISS will begin. Support of training for the B-1 Bomber and ATC micro-computers will provide the opportunity for testing and debugging ISS. Work will also begin on the development of an intelligent testbed for maintenance aiding and training. Products of this testbed will be transitioned to the Integrated Maintenance Information System (IMIS). Efforts will continue in the areas of performance and training requirements, task analysis, and Ada requirements. Development efforts will also begin to define the task, worker, and environmental factors in a selected maintenance specialty for teaching the essential skills in resident, field, and on-the-job training. In FY 1986, on-going efforts will be supplemented with the beginnings of several innovative areas of research. Ways of using symbolic performance will be evaluated and tested against hands-on performance. Investigations will look at the use of instructional gaming strategies and stand alone maintenance trainers for improving training performance and job competency. R&D efforts will continue in the test and evaluation of an intelligent testbed for maintenance aiding and training using ISS systems, and in the specification of training requirements, task analysis methodologies, and Ada software requirements.

C. (U) Project: 1123, Flying Training Development. This project applies new methods and devices to flying training and to measuring the performance of aircrews, with an emphasis on increased flying proficiency and improved transition to combat aircraft. In FY 1984, studies of aircrew electronic countermeasures training were conducted for both Strategic Air Command and Tactical Air Command. Additional R&D concentrated on determining the training effectiveness of the SAC B-52/KC-135 Weapons System Trainer. Assistance was given Military Airlift Command in the development and evaluation of continuation training programs for an aerial refueling part task trainer and the C-130 Weapon System Trainer. The test and evaluation of part task trainers continued, along with the development of an all major command requirements survey for such trainers. Some of the methods for integrating measurements of pilot performance were developed for use in the Simulator for Air-to-Air Combat at Luke AFB, AZ. In FY 1985, there will be increased efforts on simulator training effectiveness using the advanced visual system developed under PE 63227F, Advanced Simulator Technology. Visual system studies will also investigate the effects of high resolution areas of

interest and target detail on aircrew performance. Advanced sensor simulation displays will be tested for use in aircrew training in order to define hardware training effectiveness requirements. A specialized training program for tactical decision making will also be developed to enhance pilots' capabilities during hostile engagements. In FY 1986, a training program to reduce pilot workload during low-level flight will be developed. Data previously collected on the human visual, cognitive, and physical limits during low-level flight will be used. Development will start on an Artificial Intelligence (AI) model of pilot knowledge structures for use in the evaluation of combat decision making strategies during training. A feasibility study will be conducted on the Tactical Training Center concept to integrate all types of tactical aircrew training into a more efficient system. Visual scene training effectiveness studies will continue to support critical Air Force simulator acquisition decisions. Most of the hardware system characteristics evaluated in these studies are developed under PE 63227F, Advanced Simulator Technology. A behavioral performance measurement system design for use with the F-15 will be completed. Special function part-task trainers for electronic countermeasures will be evaluated and integrated into TAC's combat training program.

D. (U) Project: 1192, Advanced Simulation for Pilot Training. This project supports the operation, maintenance, and modification of simulation equipment used for training effectiveness and simulator engineering R&D. This capability includes the Advanced Simulator for Pilot Training, the Combat Mission Trainer, the Advanced Visual Technology System, and related R&D equipment. These simulation systems support most of the R&D conducted under Project 1123, Flying Training Development, and Project 6114, Flight Simulator Technology, and thus provide the primary simulation capabilities for implementing, demonstrating and testing training technology and simulation hardware developments. This capability is also used to demonstrate engineering and training simulation technology advances developed under related Aeronautical Systems Division and tri-service program elements listed under related activities. R&D efforts supported by this project are discussed under Projects 1123 and 6114. In FY 1984, operation and maintenance of the Advanced Simulator for Pilot Training and its simulation subsystems continued. The capability of transferring computer images from one subsystem to another was demonstrated using a new common data base format. The simulation support for R&D projects continued, including the tactical air combat transfer of training and visual flight simulation studies. Research studies evaluated the potential of using a helmet-mounted visual display to portray a high threat combat environment. R&D investigations of the field-of-view (FOV), intensity, resolution, and color imagery for helmet-mounted visual displays were conducted to identify possible alternatives for costly wrap-around mosaic cathode-ray tube or dome based visual systems. Demonstrations of alternative display technologies were also conducted to evaluate their application for lower cost visual displays. Simulation systems support was extended into simulation for radar imagery, low light level TV, and forward looking infrared (FLIR). In FY 1985, operation and maintenance will continue on all simulator systems, including the new Advanced Visual Technology System (Project 2363, PE 63227F, Advanced Simulator Technology). A capability for capturing Defense Mapping Agency data will be developed to increase low cost realistic simulation scene generation. Simulation support for related research projects will continue in FY 1986, including training effectiveness and transfer of training studies, visual and sensor system requirements, and tactical combat mission simulation. These efforts are discussed in more detail under Projects 1123 and 6114.

E. (U) Project: 1710, Logistics and Maintenance Technology. This project will develop technologies to improve the logistics support of Air Force combat operations. Emphasis is on methodologies to simplify and reduce the cost of maintenance, insure quick turnaround of combat sorties, and provide methods for improved logistics support operations. Efforts include methods to incorporate maintenance and logistics considerations into initial weapons system design, upgrade combat maintenance capabilities, assess the impact of battle damage on combat resources, and improve the overall maintenance and logistics support processes. In FY 1984, the final data collection and analysis phase to identify factors that impact the performance of individuals, groups and organizations in aircraft and missile maintenance were completed. R&D personnel will use this data to develop R&D priorities, and maintenance managers will apply the results to make policy, procedural, and personnel changes to improve maintenance capabilities. The specifications for a portable computer-based maintenance aiding system to enhance the capability of the maintenance technician were developed. Specifications will be used to develop a prototype portable computer capable of providing the maintenance technician automated technical orders and increased diagnostic capability for aircraft battle damage repair. The data collection and analyses to measure the capability of a unit to successfully perform maintenance or logistics support roles in combat were completed. A microcomputer system to assist planners in quickly establishing the source of repair and the amount of time required for the repair was developed. The installation of logistics support analysis record data into a computer system was completed and the B-1B aircraft defensive avionics system was programmed into this data base. A user's guide and training manuals for use of this maintenance data was published. A fault tolerant testability system which can be used in making logistics tradeoffs during weapon system design was developed. The data collection for physical variables used in the computer simulation of maintenance technicians was completed. A computer graphics model of the maintenance technician will be used in computer aided design to evaluate the maintainability of initial designs of weapon systems and related support equipment. In FY 1985, efforts will complete the definition of impacts of combat on maintenance task performance and task assignment criteria will be developed. This data will be applied to develop a methodology to identify the minimum maintenance personnel and material resources required to perform aircraft maintenance under combat conditions. The study of maintenance and logistics factors that impact combat capability will be completed. Recommendations will be provided to improve the weapon system equipment design and acquisition procedures data used in a computerized model to generate wartime demand rates of aircraft Electronic Counter Measures (ECM) equipment. Data obtained from the model will be used to determine what ECM parts would be required under wartime conditions. The analysis to determine if critical maintenance tasks can be accomplished by personnel wearing chemical biological warfare protective clothing will be completed. The feasibility of interfacing commercial computer-aided design software with the computer graphics model of the maintenance technician was evaluated. Work will continue in FY 1986 to identify personnel, job aids, and support equipment tradeoffs to minimize the manpower and equipment required to perform aircraft maintenance in a dispersed location. Development will continue on a task assignment model and methodology for identifying/selecting combat maintenance personnel and evaluating options available to fulfill the task performance requirements. The computer simulation and math model used to generate wartime demand rates of aircraft ECM equipment will be tested, validated, and the results documented. Efforts will continue to develop technology for integrating maintenance information into a single system. New computer and artificial intelligence technology will be developed where required to fulfill the Integrated Maintenance Information System requirements. A computer graphics model of a maintenance technician will be developed, and it will be interfaced with a commercial computer-aided design package. In the future, efforts will

continue to develop methodologies to simplify and reduce the cost of maintenance, insure quick turnaround of combat sorties, and provide methods for improved logistics support operations. The development and test of combat maintenance capability assessment methodologies will be completed. A user manual employing logistics and maintenance considerations during computer aided design (CAD) will be completed. The CAD model of a maintenance technician will also be completed and interfaced with manpower, personnel and training design software systems.

F. (U) Project: 3017, Command and Control Training. Combat readiness of personnel assigned to man tactical command and control (C^2) systems is directly related to their ability to efficiently operate in a rapidly changing tactical combat environment. This project will develop technology and application programs to determine training requirements, analyze wartime job requirements and performance standards, identify and model the impacts of automation on C^2 operators, analyze combat decision making, and develop advanced technology training devices. In FY 1984, a training system for a German developed computer based C^2 system which will be used by United States Air Forces, Europe (USAFE) personnel was completed. This German based computer system standardizes the C^2 system used by all North Atlantic Treaty Organization countries. The development of software and initial testing of a computerized research device, for application in the training of combat plans personnel on the Air Tasking Order generation process, was completed. A methodology which identifies specific C^2 combat job training requirements was developed. Additionally, FY 1984 accomplishments included completing a study and publishing a final report which provided an analysis and data bases for automation and the combat readiness enhancement of portions of the HQ USAFE Operations Support Center. In FY 1985, work will continue to reduce the C^2 technology gaps in the areas of team training, assessment and operator/system interaction to improve the combat readiness of tactical C^2 personnel. Final testing and delivery of a computerized device to train tactical C^2 personnel on Air Tasking Orders will occur in FY 1985. In FY 1986, work will continue to improve C^2 training, team performance, and the assessment of the combat readiness of C^2 personnel. An effort to develop a methodology for combining existing requirements analysis techniques for use during the specification, development, and procurement of new C^2 systems will begin in FY 1986.

G. (U) Project: 6114, Flight Simulator Technology. This project develops efficient and effective simulation hardware technology for future training systems. These technologies will provide sufficient mission realism for aircrew training and weapon system exercise and assessment. In FY 1984, the initial breadboard fiber-optic helmet mounted display was completed and the hardware requirements for a refined version were developed, based on training effectiveness evaluations. The continued development of the next prototype was transitioned to PE 63227F, Advanced Simulator Technology. Work was begun on the application of variable-resolution optics technologies to simulator displays. A selectively degradeable image processor was begun for use in defining simulated radar hardware training effectiveness requirements. In FY 1985, variable resolution visual display technology will be extended to include small dome displays. An improved visual display system will be pursued through the development of a high brightness, full scale Fresnel lens optical system. Increased sensor simulation realism will be developed through advanced refinements of the computer image generation processes for low light television and infrared displays. In FY 1986, the exploratory development of advanced simulator visual image technology will continue. This technology will greatly improve current visual data base and image generation methodologies, and ultimately provide timely, real world, combat mission training routes. Work will also begin on interactive multicockpit, multitask integration for flight

simulators. These exploratory developments will provide the system definitions for future fully capable complex combat mission trainers for the Tactical Air Forces.

8. (U) PROJECT CVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62206F
DOD Mission Area: #522 - Environmental and Life Sciences (ED)

Title: Civil Engineering and Environmental Quality
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984* ACTUAL	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3,700	3,300	7,125	8,278	Continuing	N/A
1900	Environmental Quality Technology	1,800	1,700	4,300	4,500	Continuing	N/A
2673	Civil Engineering Technology	1,900	1,600	2,825	3,778	Continuing	N/A

* Funding shown for information to reflect funding previously included in PE 62601F, Advanced Weapons.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element, new in FY 1986, continues efforts formerly accomplished under Program Element 62601F, Advanced Weapons. Provides technology development for civil engineering and Air Force unique environmental quality requirements of bedding down, operating, and maintaining present and future Air Force weapon systems, force readiness, and non-nuclear survivability. This goal is achieved by exploratory development in the areas of: air base survivability, post-attack repair & launch and recovery, aircraft crash rescue and fire suppression, survivable ground power, air mobile facilities, and airfield pavements; and control, detection monitoring, disposal, recovery, recycling and abatement technologies for Air Force generated pollutants and wastes. This is a science and technology program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not applicable.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: The efforts within this program are of significant interest to the other services and are specifically coordinated through the Joint Services Civil Engineering Research and Development Coordinating Group, which is responsive to the Department of Defense. This group ensures efforts are not duplicated across the services and that maximum technology transfer is obtained. In addition, the group has an airbase survivability panel which reviews post attack launch and recovery efforts. All Air Force efforts in environmental quality R&D are covered in the Department of Defense Environmental Quality Area Coordinating Paper which is specifically designed to prevent duplication within the military services and between the services and other agencies. The Air Force (HQ Air Force Engineering and Services Center) and the Navy (Naval Air Systems Command) have a memorandum of agreement to conduct joint programs in the area of aircraft fire suppression and crash rescue. This program directly funds efforts that eventually transition into Program Element 63723F, Civil and Environmental Engineering Technology. Additionally, Program Element 61102F, Defense Research Sciences funds efforts which feed to the technical areas in this PE. Program Element 62601F, Advanced

Weapons, Project 8809, Nuclear Vulnerability and Hardening Technology funds related civil engineering efforts. Duplication is avoided through frequent technical exchanges between the Air Force Weapons Laboratory and the Engineering and Services Laboratory. Other related programs are included Program Element 62203F, Aerospace Propulsion, and Program Element 62202F, Aerospace Biotechnology.

6. (U) WORK PERFORMED BY: In-house efforts are conducted by the Engineering and Services Laboratory (ESL), Air Force Engineering and Services Center, Tyndall Air Force Base, FL. The ESL laboratory facilities provide the capability for: subscale and limited full-scale protective construction and weapons effects testing, design and testing of airfield pavement materials and construction techniques, computer facility and utility design analysis, environmental chemistry research, and test and evaluation of power generation and energy conversion technology. The resources of other government agencies are also used. These include the Departments of the Army, Navy and Energy, Argonne National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory, the Environmental Protection Agency and the National Aeronautics and Space Administration. The top five contractors and associated projects are New Mexico Engineering Research Institute, Albuquerque, NM (2673); University of Florida, Gainesville, FL (1900); University of California, Irvine, CA (1900); University of Tennessee, Knoxville, TN (2673); and Southwest Research Institute, San Antonio, TX (2673). The total number of other contractors is 10 with a total additional contract dollar value of $719,000.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 1900, Environmental Quality Technology. This project provides the broad base exploratory development to address Air Force unique and time-critical problems in environmental quality. The project goal is to allow the Air Force to comply with all environmental regulations so that readiness can be maintained by allowing full deployment of new weapons systems and realistic and unimpeded peacetime training and operations. This project characterizes the chemistry of pollutants and toxic materials, assesses their transport and ultimate fate and develops control methodologies. It also investigates feasibility of alternative technologies for industrial waste treatment, process control, and material recovery and reuse. The following are brief descriptions of FY 1984 accomplishments. Mass transfer coefficients were developed to facilitate design of airstripping towers for groundwater decontamination. A new water disinfection agent was developed and found effective to support mobility water requirements. Further testing will be required to determine toxicity of the disinfectant. Anaerobic degradability of chlorinated aromatic compounds of interest to the Air Force was demonstrated. Particular mechanisms have not been completely identified, but will be investigated. A field study of a large-scale nitrogen tetroxide release provided valuable data on the dispersion and behavior of resulting dense gases. This data will be used in developing models and for designing future research efforts. Also completed was a laboratory and field study to determine the environmental fate and effects of the fuels, JP4 and JP5. This information contributes to development of the technology base as well as to our ability to devise spill control contingencies. The following are brief descriptions of planned work for FY 1985. A study of the feasibility of an infrared hydrogen chloride detector will be completed. Such a detector is required for realtime monitoring of the exhaust clouds left behind when the space shuttle is launched. Investigation of kinetics and vapor sorption of organics in soil will be initiated. A study of the toxicity of the new water disinfection agent will be completed. There will also be continuing research in the development of field monitoring techniques and instruments

for measuring pollutants and toxic materials, as well as ongoing Air Force fuels and chemical characterization studies. In FY 85 multiyear research programs on the characterization of hydrazine environmental interactions and studies of hydrazine disposal alternatives will be initiated along with studies of shale JP4. The following are brief descriptions of planned work for FY 1986. Investigative efforts for in-place chemical decontamination of dioxin, the biological degradation of chlorinated and hydrocarbon solvents, and immobilization of toxic metals in soils will all be completed. (These efforts will be initiated in FY 1985 with funds from the central Defense Environmental Restoration Account). Fifty percent of the effort in this project is directed toward exploratory development of technologies to reduce the cost of soil and groundwater decontamination to be conducted under Defense Environmental Restoration Program. The role that volitization plays in the transport of groundwater contaminants/pollution will be investigated. There will be significant ongoing research in the environmental fate and effects of shale-derived JP4 and hydrazine fuels. Also continuing will be studies of disposal alternatives for hydrazine fuels and laboratory studies of fuel additives to suppress smoke production from turbine engines. Research efforts to develop a representative JP4 which can be used as a standard for all future studies will be initiated. Also beginning in FY 1986 will be studies to characterize tar sand-derived JP4, effects of swirl-combustion on soot formation, and physical aspects of thermal destruction of Air Force specific waste.

B. (U) Project: 2673, Civil Engineering Technology. This project provides the Air Force with a broad civil engineering technology base for survivability/vulnerability analysis and design of buried and above-ground support structures to resist conventional weapons effects; development of new materials for armoring facilities; evaluation of centrifuge technology for the qualitative modeling of structural and geotechnical dynamic effects; analysis of the components of airfield pavements for decreased life cycle costs and increased wartime survivability; development of advanced fire fighting materials, methods, and equipment for aircraft crash rescue and post attack base fire suppression; and survivability of power and utility lifelines. The following are brief descriptions of FY 1984 accomplishments. Techniques were developed for suppression of fires in oxygen-enriched atmospheres using existing agents. However, existing agents were found ineffective in extinguishing magnesium fires. Centrifuge technology for modeling buried structures subjected to dynamic (blast) loads was successfully demonstrated. Comprehensive efforts under the tri-lab program (Engineering and Services Laboratory, Air Force Armament Laboratory, and Air Force Weapons Laboratory) determined existing codes for predicting the response of buried structures to weapons were inadequate. The feasibility of using radioluminescent lights for contingency airfield lighting was demonstrated. The following are brief descriptions of planned work for FY 1985. A new fire suppressant agent for magnesium fires will be developed. The feasibility of developing a robotic fire fighter for high hazard situations will be evaluated. The tri-lab program will continue to define and model buried conventional weapon effects including centrifuge modeling and new models for predicting response of buried and above-ground structures. Material characterization of matrices of very high strength cement and fiber meshes will be completed. This material has potential applications as lightweight armor and energy dissipator for retrofit blast protection. Exploratory development of these potential uses will begin in FY 1986. The principal parameter controlling the stripping of asphalt concrete pavements will be identified. Factors affecting the rutting of asphalt concrete airfield pavements subjected to heavyweight fighter aircraft with high pressure tires will be studied. The following are brief descriptions of planned work for FY 1986. Exploratory efforts in the feasibility of applying robotic technology in hazardous fire fighting situations will continue. The in-depth assessment of the

total fire suppression and crash rescue requirements for a typical tactical air base will be finalized. The parameters affecting ultra-strength concrete and potential uses for it will be identified and evaluated. The tri-lab program will continue efforts including the extension of centrifuge technology in the definition of conventional weapons effects and survivability/vulnerability analysis of buried and above-ground support structures. The mechanism that controls spalling of concrete walls from explosions will be quantified. A study to define post attack air base critical facility and utility rapid repair requirements will be initiated. Exploratory development of survivable power for fixed tactical airfield facilities using antenna theory for converting solar energy to electrical energy will be initiated. Development of centrifuge methods for simulating explosive conditions will continue.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62302F Title: Rocket Propulsion
DOD Mission Area: #523 - Engineering Technology (ED) Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		35,400	34,500	41,661	47,228	Continuing	N/A
06RL	Laboratory Operations	12,420	12,000	12,869	13,436		
2864	Interdisciplinary Space Tech	1,888	2,350	3,688	4,328		
3058	Space Propulsion Tech	6,986	7,258	9,242	10,849		
3059	Ballistic Missile Prop	4,136	4,056	5,035	5,912		
3148	Air-Launched Missile Prop	4,945	4,159	4,747	5,540		
5730	Multiple Application Tech	5,025	4,677	6,080	7,163		

* Excludes January 1985 Civilian Pay Raise (393)

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Science and Technology program develops new concepts and techniques in rocket propulsion and interdisciplinary space technology to provide required future mission capability, cost effective weapons and more reliable, maintainable systems. The need to launch larger payloads at lower cost and deliver more munitions to longer ranges is met by the technology products from this program. An increase in effort in FY 1986 is in response to the need to significantly reduce the cost of access to space. This need is documented in the Air Force Space Plan and supports the National Space Strategy as described in National Security Decision Directive NSDD-144. The program also provides for the management and support of the Rocket Propulsion Laboratory at Edwards Air Force Base, CA. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	35,210	40,020	45,416		Continuing	N/A

The FY 1985 funding was reduced by Congress. No rationale was provided. The reduction to FY 1986 funding was a result of Air Force adjustments to align overall exploratory development with budget priorities.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Military Construction: Funds	5,400	4,750	2,450	5,392	Continuing	N/A

5. (U) RELATED ACTIVITIES: This technology base program in rocket propulsion complements the programs of other Department of Defense agencies and NASA. The Joint Army-Navy-NASA-Air Force (JANNAF) interagency propulsion committee coordinates these technology programs through the use of interservice-subcommittees to ensure no duplication of effort occurs. This exploratory development program, 62302F, provides basic technology to Program Element 63302F, Space and Missile Rocket Propulsion which will integrate and demonstrate this technology so that it can transition to Air Force weapons systems.

6. (U) WORK PERFORMED BY: Air Force management of this effort is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA, and is accomplished through the management of contractual as well as comprehensive in-house efforts. The in-house efforts are conducted at numerous active experimentation areas to evaluate sub- and full-scale rocket propulsion systems and components. The top five contractors in FY 1985 were Thiokol Corporation, Brigham City, UT and Huntsville, AL, (Projects 3058, 3059 and 5730); Hercules, Inc., Magna, UT (Projects 3058, 3059, 3148 and 5730); Rockwell Corporation, (Rocketdyne Division), Canoga Park, CA (Projects 3059 and 3058); Aerojet Strategic Propulsion Company, Sacramento, CA (Projects 3059 and 5730); and Chemical Systems Division, Sunnyvale, CA (Projects 3059, 3058 and 5730). There are 55 other firms with contracts totaling $25 Million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2864, Interdisciplinary Space Technology. This project provides the integration of key propulsion and non-propulsion disciplines necessary to develop enabling technology for future Air Force space systems. Technologies addressed include the dynamics and control of large space structures, advanced thermal management concepts, spacecraft contamination control, satellite autonomy, and unique military concepts for future space systems. In FY 1984 this project demonstrated at laboratory scale how to control the shape of a large space system. In FY 1985 this project will gather the first space data on electric thruster contamination. In FY 1986 this project will investigate the use of propulsive and gyro devices to control large space structures. This technology will be required to enable the use of large structures with sensitive instrumentation and requiring accurate control.

B. (U) Project: 3058, Space Propulsion Technology. This project will provide technology required for survivable and reliable operations in space, in both war and peacetime; for cost-effective access to all orbits; and for survivable on-demand access to space. The capability for constant access to space and for placing and maintaining systems in space is critical to ensuring national security. Areas of investigation include satellite propulsion, orbit transfer and upper stage propulsion, advanced quick-reaction space vehicles, and exhaust plume technology. In FY 1984 this project verified the performance of film-cooled turbine blades for long life liquid oxygen/hydrogen engines. It also demonstrated an advanced augmented hydrazine thruster which would provide more than double the total impulse capability of the current engines. In FY 1985 this project will define satellite evasive maneuvering strategies based on propulsion technology studies. It will also have a satellite feed system leak detector ready for space flight experiments. Concepts will be defined for low cost launch vehicles that will enhance our access to space. In FY 1986 this project will investigate and select designs for an advanced space vehicle propulsion system to define technology drivers. This will provide a capability for assured access to space. It will also develop feed system technology for modular/storable

space propulsion which will allow for one system flexible enough for application to a wide range of missions requiring orbit transfer. Finally, it will demonstrate technologies for low cost launch concepts defined in earlier studies.

C. (U) Project: 3059, Ballistic Missile Propulsion Technology. Future strategic forces must reflect a mix of characteristics to enhance survivability. Chief among these characteristics is flexibility in basing. Rocket propulsion technology options will reduce the development risk of future survivable, enduring strategic missile forces. Solid rocket motor technologies, when used in a small mobile ballistic missile, would provide a 30 percent increase in range or payload. This increased capability will be used for reduced missile weight or increased weapons delivery on target. This project has identified manufacturing variables which affect the operational service life of ballistic missiles. Control of these variables will allow for increased life of a missile in the field. This project has also developed new analytical techniques to develop propellant properties more accurately which allow for more precise design and reliability of future systems. In FY 1984 this project developed and transitioned the technology for a wound elastomeric insulator to the Peacekeeper missile system. This project has evaluated new techniques for attaching exit cones to allow enhanced reliability during operation. In FY 1985 this project will conduct a total thermostructural analysis for the small ICBM which is critical to insure proper design margins. Finally, an effort will begin to investigate and understand the interfacial bonding processes, the area where most rocket motor anomalies have occurred. In FY 1986 this project will begin an effort to apply new service life structural integrity evaluation technology to hardware in the field. This effort will verify the techniques to ensure they are available in time for application to small ICBM designs. Technology definition efforts that will examine a Fast Launch ICBM (FLICBM) or a Hot Missile System will be initiated. These are concepts for short burn time missiles that will significantly reduce the possibility of boost phase intercepts. Further investigation will continue into failure mechanics of 2D and 3D carbon-carbon nozzle materials. This vital information is necessary to understand and avoid problems of motor malfunction due to nozzle failure.

D. (U) Project: 3148, Air-Launched Missile Propulsion Technology. The propulsion technology in this project covers both strategic and tactical missile applications. Tactical missile propulsion technology is aimed towards improving performance and flexibility to increase the probability of kill, and to develop propulsion systems with almost no visible rocket plume signature. Advanced air-launched strategic missile propulsion technology strives to maximize standoff range and provide a variable trajectory capability to improve aircraft survivability and insure weapon penetration to the target. This project has demonstrated a new high performance, lower cost polymer for use in reduced and minimum smoke propellants. This polymer, glycideiazide can provide minimum smoke propellant without the considerable performance degradation normally associated with minimum smoke propellants. In FY 1985 this project will demonstrate the feasibility of a laser arm-fire device which would replace current mechanical devices and produce a large cost savings per missile. Work will begin on the development of a class 1.3, non-explosive hazard, minimum smoke propellant in order to provide reduced handling problems associated with class 1.1, explosive hazard, propellants. In FY 1986 this project plans to initiate a program that will develop a data base for low observable propellants. This must be done to quantify the capabilities of propellants under the various signature categories such as infrared, ultraviolet, visible, etc. Efforts to develop in-house composite case design and analysis capabilities to meet the

future application of composite cases for the air-launched environment will be continued. Finally an effort will be initiated to identify composite case attachment designs to provide further weight reduction.

E. (U) Project: 5730, Multiple Applications. This project includes those propulsion technologies which have many areas of application. This project develops technology to meet the need for generic systems reliability to alleviate failures like those experienced by the Inertial Upper Stage (IUS), the shuttle solid rocket boosters and the payload assist module (PAM-D). These include; understanding combustion; propellant ingredients, and service life determination; and advanced propulsion concept feasibility investigations. Emphasis is placed on defining those unique approaches that may be technology breakthroughs. This project demonstrated a one pound thrust class magnetoplasma dynamic (MPD) thruster which is anticipated to be the choice of the future for orbit transfer vehicle propulsion because of its high specific impulse. It also demonstrated the feasibility of a propellant nozzle which could provide cost savings for a system like the Shuttle Solid Rocket Boosters (SRB). In FY 1985 this project will build up the solar experimentation facility to test a new solar thermal propulsion system that will be used in future reusable orbit transfer vehicles. It will demonstrate the use of an insuliner which performs a dual role of insulation and liner in a solid rocket motor. This insuliner will reduce cost and significantly increase motor reliability by eliminating a number of bond sites. In FY 1986 this project will initiate an effort to account for composite case/propellant grain interactions. This is needed since future missiles will require designs that can survive a mobile environment. This area is as yet unexplored. Finally, an effort to apply glycidelazide polymer (GAP) propellant to a number of areas (i.e., ducted rockets, low hazard ICBM, and non-hydrochloride producing solid rocket motors) will be initiated to take advantage of the increased performance it offers.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06RL, Laboratory Operations.

A. (U) Project Description: This project funds support activities required to conduct the technology programs and to operate the Air Force Rocket Propulsion Laboratory at Edwards Air Force Base, CA. This project provides support for an in-house program covering the following areas: rocket propulsion phenomenology investigations, new concepts feasibility evaluations and systems support to AFSC product divisions. It covers direct and related costs of civilian scientists, engineers and supporting personnel; transportation, rent, communications and utilities cost; and procurement of supplies, equipment, and contractor support services. This project supports and complements all projects in this program element.

B. (U) Program Accomplishments and Future Efforts: Not applicable.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62601F
DOD Mission Area: #521 - Electronics & Physical Sciences (ED)

Title: Advanced Weapons
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		48,354	36,894	37,020	43,352	Continuing	N/A
06WL	Laboratory Operations	16,245	16,300	15,997	17,182	Continuing	N/A
1900	Environmental Quality Technology	1,800	1,700	(In PE 62206F in FY 1986 and Beyond).			
2007	Nuclear Safety	800	900	1,000	1,340	Continuing	N/A
2218	Directed Energy Weapon Survivability/Vulnerability Technology	800	900	1,700	2,000	Continuing	N/A
2673	Civil Engineering Technology	1,900	1,600	(In PE 62206F in FY 1986 and Beyond).			
3326	Laser Applications	15,898	6,030	8,055	10,800	Continuing	N/A
5797	Advanced Weapons Concepts	5,200	2,900	3,555	3,884	Continuing	N/A
8809	Nuclear Survivability and Hardening Technology	5,711	6,564	6,713	8,146	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops options for advanced weapons and their application to future Air Force systems. Studies and experiments are conducted in charged particle beam technology, laser applications, survivability/vulnerability, advanced weapon concepts, and nuclear weapon environments. Management and support of the Air Force Weapons Laboratory at Kirtland Air Force Base, NM, is also included. This is a Science and Technology Program. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	45,664	44,794	45,170		Continuing	N/A

For FY 1985 the $2.9 million in Defense Environmental Restoration Program funds were removed from project 1900 and placed in a central account. For FY 1985, Congress reduced the program by $5 million. The total amount has been taken from project 3326, Laser Applications. This forced a restructuring of the program to include only those technology efforts required for Air Force tactical applications. Several technology efforts such as the silicon faceplate deformable mirror were deleted. For FY 1986 project 1900, Environmental Quality, and project 2673, Civil Engineering Technology, have been placed in Air Force PE 62206F, Civil Engineering and Environmental Quality. For FY 1986 and

beyond project 2218, Directed Energy Weapon Survivability/Vulnerability Technology has been restructured to include all directed energy weapons, not just lasers.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Nuclear weapons efforts are closely coordinated with programs funded by the Defense Nuclear Agency Program Element 62715H, Defense Nuclear Agency. Technology developed through this program element directly supports increased nuclear survivability efforts for Advanced Strategic Missile Systems, Program Element 63311F, and Air Force Systems Survivability (Nuclear Effects), Program Element 64711F. Exploratory laser development supports the Air Force Advanced Radiation Technology Program Element 63605F. In Project 5797 there is a joint program with Sandia National Laboratory in charged particle beam research. This effort deals with the Radial Linear Accelerator (RADLAC) research. With the advent of the Strategic Defense Initiatives Program (SDIP), there is close coordination between this program element and the SDIP Directed Energy Weapons Program Element 63221D. This coordination is designed to ensure that maximum Air Force use is made from the SDIP technology applicable to non-SDIP Air Force applications.

6. (U) WORK PERFORMED BY: The Air Force Weapons Laboratory at Kirtland Air Force Base, NM, manages all of the work performed under this program element. Air Force Weapons Laboratory facilities involved in the work include the Impact Facility, the Directed Energy Experimental Range, the Laser Laboratory, the Shiva Electromagnetic Implosion X-Ray Source, the Dipole and Trestle electromagnetic pulse simulators and the Civil Engineering Research Facility. The top five contractors are: TRW, Redondo Beach, CA (Project 3326); Bell Aerospace, Buffalo, NY (Project 3326); Computer Science Corp, Systems Division, Albuquerque, NM (8809); RDA, Marina Del Rey, CA (8809) and Maxwell Labs, San Diego, CA (8809). There are 54 additional contracts with a value of $25.4 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2007, Nuclear Safety. This project provides the technology for the Nuclear Safety Program. It furnishes nuclear safety support to Air Force systems, technical support to the Nuclear Weapon System Safety Group and assistance in accomplishing nuclear safety/risk assessments for space systems which utilize nuclear power or radioactive sources. This project also investigates the technology associated with nuclear safety. The three major areas of effort in this project are aircraft/missile nuclear safety, nuclear power system safety and nuclear weapon surety analysis and technology. In the area of aircraft/missile nuclear safety a number of operational reviews have been or will be conducted starting with the F-15 Dual Role Fighter in FY 1984, the B-52 and F-4 in FY 1985 and B-1B, F-111E, Medium Range Combat Aircraft and NATO F-4E in FY 1986. The nuclear safety analysis report for the Minuteman F/G missile swap out was performed in FY 1984. In FY 1985 the Ground Launched Cruise Missile two year operation review will be completed and in FY 1986 the technical nuclear safety analysis for these systems will be completed. In FY 1984 the Minuteman II ballistic shroud was designed, developed and accepted and a feasibility demonstration was completed on the nuclear weapon secure container. This work is being followed in FY 1985 by the building and field testing of a shroud prototype for the Minuteman II Mark 12/12A reentry system. In FY 1986 the Mark 12 shroud effort

will be completed. These shrouds will increase the surety of nuclear weapons against terrorist attack during transportation. The automated fault tree generation methodology work was undertaken in FY 1984 and will be used in FY 1985 to enhance nuclear surety analyses. A follow-on effort in FY 1986 will combine the existing algorithms to allow commprehensive nuclear surety analyses. In FY 1988 space reactor safety requirements will be issued. These requirements will complete a series of space reactor safety studies started in FY 1984. The Weapons Transport Van study started in FY 1985 will be complete in FY 1990. The Nuclear Safety Analysis Computer program for the Small Intercontinental Ballistic Missile, started in FY 1986, will be complete in FY 1992.

B. (U) Project: 2218, Directed Energy Weapon Survivability/Vulnerability Technology. This project has been broadened to include all directed energy weapons. The objective of this project is to quantify the survivability/vulnerability level of U.S. systems to various types of directed energy radiation. This includes experimental and theoretical efforts to determine the effects of directed energy radiation on various U.S. aerospace materials and components, the development of models to assess system vulnerability based on known directed energy effects, the validation of vulnerability estimates by high power testing, and the identification of the most vulnerable areas of U.S. systems for possible future improvements in system survivability. The upgrade of an in-house laser device to 40 kW will be completed, and in-house laser effects testing of various materials will be re-initiated. Building upon work begun in FY 1984, a proof of principle test of a simulator concept for short wavelength pulsed lasers will be conducted in FY 1985. This test will demonstrate the viability and performance limits of the simulation technique as a substitute for high energy laser testing. Simulation techniques have a high payoff, particularly for short wavelength pulsed lasers, because of the reduced cost compared to direct laser testing and because of the limited number of high energy laser devices available for laser effects testing. Work will continue in FY 1985 and FY 1986 on the upgrade of computer codes for vulnerability assessment, to improve the methodology and improve the modeling capability for a wider range of visible wavelength lasers, microwave weapons and particle beam weapons. For FY 1986 experiments with a variety of materials and countermeasure concepts will continue to broaden the overall directed energy effects data base; where support facilities are available, testing will be conducted with lasers at different wavelengths and laser waveforms (continuous wave and repetitively pulsed) as well as with an in-house charged particle beam device. A laser material interaction study will continue in FY 1986. This analysis supports the experimental testing by providing a foundation for the understanding of test results and providing a theoretical basis for the development of scaling laws for larger laser spot sizes, higher intensities, shorter wavelengths, and differing laser waveforms. Drawing upon the data base of laser effects, computer models will be used to describe U.S. systems and assess the overall vulnerability of the system to laser radiation. Included in this work is the analysis of the response and performance of systems with various types and levels of damage.

C. (U) Project: 3326, Laser Applications. This project provides the technology base to establish the technical and operational practicality of visible wavelength high energy lasers as weapons to fullfill Air Force tactical and other broad based generic applications. In prior development efforts, the basic feasibility of high energy lasers in short range (5km) applications has been successfully demonstrated. These results, coupled with continuing technology applications analyses, indicate that high energy laser weapons will have a high payoff in a broad range of Air Force applications, such as aircraft defense against missiles or other aircraft. To provide the technology for the possible

development of such weapon systems, additional technology development is essential to (1) establish the technology for scaling to the high brightness levels required for the applications (2) explore technology options to reduce the size and weight of laser weapon systems, minimizing the impact upon the weapon system platform, and (3) investigate technology concepts to significantly improve potential system reliability and reduce acquisition time and costs. Effort within this project emphasizes the investigation of advanced technologies. This will establish the foundation for substantial improvements in high energy laser system performance and capabilities over the long term. Included in the scope of this project are the study of small, highly efficient visible laser device concepts; diagnostic evaluation, modeling, and kinetics studies for visible wavelength chemical lasers; design and fabrication technology for high energy laser optical components; the analysis and investigation of advanced beam control and beam generation concepts, including adaptive optics and advanced resonator designs; the investigation of high energy laser phenomenology including linear and nonlinear propagation; effects on materials; and studies and analyses of potential applications of high energy laser systems. This program also provides the Air Force the technical expertise to prevent any technological surprise in tactical lasers. During FY 1984 lasing was demonstrated in-house for the oxygen-iodine chemical laser with supersonic flow. This will allow scaling to high power. This work on an infrared laser is important because of another new development in FY 1984, which permitted frequency doubling for this laser. This will allow operation in the visible. During FY 1985 the efficiency and scalability of this concept will be validated. The program will transition to PE 63605F, Advanced Radiation Tecnology, in FY 1986. Other visible wavelength lasers, such as iodine monofluoride and several nitrogen-pumped laser concepts, will be demonstrated in FY 1985 and the most promising will transition to PE 63605F, in FY 1986. Other promising, but less mature, visible wavelength devices will continue to be investigated in this project in FY 1986. These advanced chemical lasers may provide a relatively small, high efficiency alternative for use in Air Force tactical applications. In FY 1984 a new laser concept, Phased Integrated Laser/Optics Technology (PILOT) was invented in-house. The follow-on effort offers significant promise for many Air Force applications. During FY 1985 the concept will be validated by analysis and experiments and will transition to PE 63605F in FY 1986. PILOT came from speculation on a related effort and is an excellent example of the creative work to come from this project. Several optics technology efforts are contained within this project. In FY 1984, the initial coupling of laser devices was demonstrated. This technology will allow scaling in power by coupling a number of smaller laser devices rather than building a single large device. Since FY 1984 work has concentrated on the development of components for visible wavelength lasers. The optics will require an order of magnitude better performance than current high power optics. Work is also ongoing on new windows, adaptive optics, resonator designs, and coating designs. In the area of adaptive optics revolutionary techniques are required. Since conventional mechanical pistons used to deform the mirror surface introduce too much jitter for use with these new shorter wavelength lasers, work will begin in FY 1986 on the development of a low vibration mirror for potential use in beam control systems for tactial applications where stringent limits are placed on vibration-induced jitter. These new technologies include spatial light modulators and nonliner techniques such as stimulated Brillouin scattering. The small size of these components make them particularly attractive for Air Force high energy laser applications. A spatial light modulator breadboard will be developed in FY 1986. New aperture sharing technologies allowing visible wavelength laser and tracking systems to use the same telescope will be investigated in FY 1986. Work will continue on the upgrade to include visible wavelengths in the applications analysis and system performance computer codes.

D. (U) Project: 5797, Advanced Weapons Concepts. This project does exploratory development of the technology associated with advanced weapons concepts (excluding lasers). Conceptual and feasibility studies based on Air Force requirements for new nuclear weapons are done within this project. In addition high power microwave studies and charged particle beam technology development are accomplished within this project. The high power microwave efforts have a high payoff in the tactical arena in directed energy weapon applications. Charged particle beam weapons may have considerable payoff against tactical missles by causing material damage to the missles or its electronics subsystems. Analytical concept reports on the Advanced Air-to-Surface Missile (AASM), the small Intercontinental Ballistic Missile (SICBM), the advanced strategic bomb, and a utility assessment on the Excaliber concept were completed in FY 1984. The AASM and SICBM analytical feasibility studies initiated in FY 1984 will be completed in FY 1986. FY 1984 saw the design and construction of the Radial Linear Accelerator (RADLAC) II electron accelerator for charged particle beam research and the completion of the pulse power systems for RADLAC II. In FY 1985 beam extraction and beam propagation experiments will be conducted. In the area of high power microwave research, mode locking experiments will be performed and a weapon concept design study will be initiated in FY 1985. Experiments will continue with the goal of demonstrating 100 GW microwave power capability in FY 1989. A multimegawatt reactor concept was designed in FY 1984. FY 1985 through FY 1987 will see efforts in thermal control of reactors, reactor kinetics, radiation source definition for a heat pipe reactor and an assessment of reactor materials in relation to radiation induced creep. Heat pipe research will be completed in FY 1987.

E. (U) Project: 8809, Nuclear Survivability and Hardening Technology. This project develops the basic technology required to implement survivability into the Air Force system developmental process. The emphasized nuclear environment includes electromagnetic pulse, transient radiation effects on electronics, thermal, blast and shock, and x-rays. Specific areas of technology being addressed are: (1) development of recommended nuclear survivability criteria for U.S. systems; (2) development of the basic simulation technology critical for Survivability/Vulnerability assessment of U.S. systems/components; (3) development and verification of simulation codes; (4) development of the technology base essential for the understanding of nuclear environments and their effects; and (5) development of the technology base essential for the nuclear hardening of U.S. systems. During FY 1984 a validation study of an aircraft thermal radiation environment code was initiated and completed. A hardness assessment of the F/A-18 was initiated. Radiation hardened electronics technology accomplishments included radiation damage studies on optoelectronic systems, data processing on radiation environments and an evaluation of the total dose radiation response of analog multiplexers. A total dose ground test was completed for the Combined Radiation Release Experiment Satellite Microelectronics Package. Support to this program will be completed in FY 1987. The total dose shielding calculation for the Block II Global Positioning Satellite (GPS) was performed in FY 1984. Total systems dosimetry data for the GPS will be completed in FY 1988. Analysis for MILSTAR satellite-to-satellite link criterion will be initiated in FY 1985 and completed in FY 1986. Based on the fuze opening switch experiments conducted on the Shiva x-ray simulator in FY 1984, a coax gun opening switch will be evaluated in FY 1985, designed in FY 1986 and demonstrated in FY 1987. This work coupled with theoretical studies started in FY 1984 will lead to a lab demonstration of an implosion driven x-ray laser in FY 1987. Evaluation of alternative power sources for the High Energy Research and Technology Facility and the engineering design for the facility will be completed in FY 1986.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06WL, Laboratory Operations.

A. (U) Project Description: This project provides for the management and support of the Air Force Weapons Laboratory (AFWL), Kirtland Air Force Base, NM. The AFWL is responsible for exploratory, advanced, and engineering development programs associated with nuclear and other nonconventional advanced weapons, including studies of effective delivery techniques and hazards of these weapons. This project provides for the pay and related costs of civilian scientists, engineers, and supporting personnel in the AFWL; travel and other transportation costs; costs for AFWL personnel training, facility projects, and communication lines, rental and maintenance costs for administrative equipment; nontechnical contractual services; and procurement of administrative supplies and equipment. This project supports and complements all other projects in this program element.

B. (U) Program Accomplishments and Future Efforts: Not applicable.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62602F   Title: Conventional Munitions
DOD Mission Area: #523 - Engineering Technology (ED)   Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Name	FY 1984** Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional To Completion	Total Estimate Costs
TOTAL FOR PROGRAM ELEMENT		39,408	42,820	44,819	50,490	Continuing	N/A
06AL	Air Force Armament Laboratory Operations	12,990	13,364	13,758	14,901	Continuing	N/A
2068	Advanced Seeker Technology	5,975	7,246	8,065	11,489	Continuing	N/A
2502	Ordnance Technology	8,921	8,652	9,590	11,225	Continuing	N/A
2543	Weapon Effectiveness Methodology	3,638	3,258	3,700	3,622	Continuing	N/A
2567	Aeromechanics Technology	6,970	8,674	8,506	8,053	Continuing	N/A
2946	Chemical Warfare Technology	914	1,626	1,200	1,200	Continuing	N/A

* Excludes January 1985 civilian pay raise of $517K.

** FY 84 Project funding reflects a comparability restructure.

This program element has been restructured to align project responsibilities with the organizational structure in the Air Force Armament Laboratory. This realignment will streamline project management, maximize program coordination and technology transition. Project 2068, previously titled "Guided Weapons Technology and Simulation," is now focused at missile seekers and processor technology with midcourse guidance and missile flight control technology transferred to Project 2567. Project 2567 previously titled "Weapons Carriage and Release Technology" has been expanded to include all technology associated with carriage and release, aerodynamics and free flight control of Advanced Weapon Airframes. Efforts supporting submunition dispensing and ballistic technologies have been moved from Project 2502 to 2567. Project 2560 "Direct Fire Weapons Technology" has been incorporated into Project 2502 and Project 2560 has been deleted.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Science and Technology Effort. This program maintains and advances the Air Force technology base to support development of air-delivered conventional and chemical weapons. This technology is vital to a credible deterrent posture which sustains the nuclear threshold and provides opportunities to raise that threshold. The program includes: (1) design and feasibility demonstration of advanced air-delivered munitions, including cluster munitions, target-activated munitions, warheads, explosives, and fuzing; (2) guidance, navigation, and control necessary for effective delivery of these weapons; (3) the DOD technology base for air-delivered

chemical weapon systems; (4) reliable, supportable aircraft guns, ammunition, ancillary support equipment; (5) advanced low drag weapon airframes, conformal carriage techniques, and improved submunition dispensing techniques and (6) development and use of weapon evaluation and effectiveness methodologies and their associated data bases in support of all Air Force nonnuclear weapon development efforts. This program also funds the management and support of the Air Force Armament Laboratory (AFATL) at Eglin AFB FL.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional To Completion	Total Estimate Costs
RDT&E	39,500	42,820	49,074		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Military Construction Funds	940	4,500	5,700	0

5. (U) RELATED ACTIVITIES: This program is the only Air Force exploratory development program for conventional and retaliatory chemical munition technology and provides the technology base to support the following Air Force advanced and full scale development programs: 63307F, Airbase Survivability; 63312F, Advanced Concepts; 63601F, Conventional Weapons Technology; 63609F, Advanced Attack Weapons; 64314F, Advance Medium Range Air-to-Air Missile; 64602F, Armament Ordnance Development; 64604F, Submunitions Development; 64607F, Wide Area Anti-Armor Munitions; 64609F, Logistics Technology for Weapon Systems; 64314F, Medium Range Air-to-Surface Missile; 64617F, Air Base Survivability; and 64733F, Surface Defense Suppression. Related Army and Navy programs include: 62303A, Missile Technology; 62617A, Small Caliber and Fire Control Technology; 62618A, Ballistic Technology; 62622A, Chemical and Smoke Munitions; 62332N, Surface/Aerospace Warfare Weapons. These related programs are coordinated through formal and informal channels to prevent unnecessary duplication of effort and to maximize the payoff from research and development expenditures. Formal coordination of efforts within these programs has been through Memoranda of Understanding and Agreement (MOUs and MOAs) with the Air Force Weapons Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Engineering Services Center, Army Missile Command, Naval Weapons Center, Naval Air Systems Command, and Defense Advanced Research Projects Agency. Additional coordination is accomplished through participation in the following joint service groups: Joint Tactical Coordinating Group for Munitions Development and Munitions Effectiveness, Joint Director of Laboratories Committee, Joint Service Fuze Managers, Joint Service Seeker Working Group, Joint Army Navy NASA Air Force Interagency Propulsion Committee (JANNAF), Tri-Service/Industry Infrared Working Group, Joint Services Guidance and Control Committee, Technical Coordination Program (TTCP), Joint Conventional Ammunition Program, and Joint Service Retaliatory Chemical Warfare Working Groups.

6. (U) WORK PERFORMED BY: This program is managed by the Air Force Armament Laboratory (AFATL), Eglin Air Force Base FL. The AFATL has the following in-house facilities: Interior Ballistics Facility, Aeroballistics Research Facility, Ballistics Experimentation Facility, Gun Mechanisms Laboratory, High Explosives Research and Development Facility, Guidance and Control Laboratory, Missile Simulation Laboatory, Radio Frequency Millimeter-Wave Laboratory, Laser and Optics Laboratory, Digital Image Processing Laboratory, Electro-mechanical Fuze Laboatory, Sensor/Fuze Data Collection and Analysis Laboratory, Hopkinson Bar Facility, Computer and Graphics Analysis Laboratory, Environmental Research Laboratory, Technical Library and Model Shop. The work is performed by industrial contractors, education institutions DOD and industry contract and in-house. The major contractors are: Vought Corp, Dallas TX (Projects 2068, 2502, and 2567); Raytheon Co, Bedford MA (Project 2068), General Electric Co, Schenectady NY (Project 2502); Rockwell International, Columbus OH (Project 2567); and Lockheed, Sunnyvale CA (Project 2502). There are 35 additional contractors. Contracts total over $50.0 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) PROJECT: 2068, ADVANCED SEEKER TECHNOLOGY. This project provides advanced seeker technology to support development of conventional air-to-surface and air-to-air munitions; advances the technology base for delivery of weapons in adverse weather; provides effective terminal guidance of advanced weapon systems with increased weapon delivery accuracy and longer standoff delivery ranges, more precise aimpoint selection, offset aiming for buried hard targets, and autonomous target acquisition and terminal guidance. Application of technology developed under this project will support development of more cost effective weapon systems by increasing kills per sortie and increasing delivery aircraft survivability. Also provides the Air Force the capability to evaluate operational merit and design feasibility of guided weapons in a laboratory environment, thus reducing costs and risks of guided weapon development efforts. Achievements in FY 1984: completed modification and update of aerodynamic parameter identification software models and initiated verification of modifications in hybrid and digital six-degree-of-freedom simulations; established feasibility and completed initial designs of low cost laser radar seeker concepts for autonomous, precision guidance of conventional weapons; completed preliminary designs of an analog parallel image processing chip to increase image processing capability such that lower cost, less complex staring scene focal plane arrays can be used in place of gimballed scanning arrays in weapon seekers; completed upgrade of the Image Processing Laboratory providing the capability to conduct real time simulations to evaluate and verify algorithms for autonomous seekers and enable image processing algorithm development; and continued joint effort with West Germany to format and analyze millimeter wave (mmW) scene data to aid in design, development, and evaluation of autonomous, all-weather terminal seekers. FY 1985 efforts will: complete implementation of missile simulation lab upgrades designed to enable operation of multiple simulations simultaneously, thus increasing efficiency and effectiveness of weapon system simulation and analysis; initiate development of a spatial and spectral extended source infrared (IR) target simulator to support development of imaging IR seeker technology for providing real time dynamic IR scene generation and flicker free dynamic IR source projection; initiate design of a millimeter wave simulator capability; continue the Extended Range Air-to-Air Technology assessment and analysis aimed at identifying technology requirements necessary to provide Advanced Medium Range Air-to-Air Missile (AMRAAM) product improvements necessary to meet evolving threats beyond 1995; initiate the breadboard

design and target classification algorithm development for a low cost, autonomous tactical laser radar seeker concept which was developed in FY 1984; initiate design and breadboard fabrication of inexpensive, compact hybrid optical seeker which uses optical techniques instead of electronics for preprocessing of imaging data resulting in over 100 times increase in throughput capability thus allowing more precise target identification and classification; fabricate and verify parallel image processing chips (designed during FY 1984) which provide processing capability necessary to use staring scene focal plane arrays in place of scanning gimballed arrays, thus reducing cost and increasing reliability of advanced optical seekers; initiate joint AF and Defense Advanced Research Projects Agency (DARPA) effort in millimeter wave algorithms for autonomous all weather guidance; initiate development of polarimetric radar technology for application to low cost autonomous all weather seekers. FY 1986 efforts will: continue the FY 1985 development effort to add real time seeker analysis and evaluation capability to the IR target simulator; finalize designs initiated in FY 1985 for a millimeter wave target simulator capable of hardware-in-the-loop simulation and analysis to support development of low cost autonomous all-weather seekers (fabrication and incorporation into the Air Force Armament Laboratory Missile Simulation Laboratory will occur in FY 1987); complete test and evaluation of laser radar breadboards fabricated during FY 1985 and transition the technology into advanced development; continue the effort initiated in FY 1985 to develop and evaluate low cost hybrid optical seekers concepts incorporating optical processing techniques to increase throughput capability over 100 times enabling greater precision in target identification and classification (test and evaluation and technology transition will occur in FY 1987); continue the AF/DARPA effort initiated in 1985 to develop millimeter wave seeker algorithms for autonomous all-weather guidance against armor targets (incorporate algorithms into a seeker in FY 1987); continue development of polarimetric radar technology (incorporate technology into FY 1988 Advanced Development effort for a low cost precision autonomous all-weather seeker effective against high value fixed targets).

B. (U) PROJECT: 2502, ORDNANCE TECHNOLOGY. This project provides the technology base for design and feasibility demonstrations of advanced air-launched weapons which meet conventional munitions requirements for increased lethality, multiple target kill and reduced delivery aircraft exposure. Provides analytical and experimental simulation and analysis of advanced concepts in cluster munitions, warheads, fuzing, and target activation technologies. Provides technology base for advanced aircraft guns, ammunition, and related component technologies for air-to-air and air-to-surface combat operations. Achievements in FY 1984: established feasibility of reactive fragment kill mechanism to increase lethality of warheads against air targets and soft ground targets; continued coordinated effort with the Army on evaluating effectiveness of large length to diameter heavy metal penetrator rod designs against selected advanced armor configurations; continued investigations of the processes for forming jets from advanced warhead materials and the interaction of these jets against a range of future threat targets; initiated investigations of advanced, deep penetrating warhead designs for use against vital complex hardened underground targets; initiated development of techniques for enhancing the blast of penetrating warheads to increase their lethality; initiated development of defense suppression submunition technology aimed at achieving over five times increase in effectiveness in lethal defense suppression operations; initiated development of a depth of burial fuze which uses deceleration information to obtain warhead detonation at optimum penetration; established feasibility of optical proximity sensor which utilizes fiber optic feeds to enable improved aerosol and chaff discrimination for air-to-air missile applications; continued

development of insensitive high explosives aimed at increasing the handling and storage safety of munitions and relieving severe storage problems experienced in European scenario without compromising explosive performance; initiated study and analysis of advanced barrel concepts aimed at increasing barrel life by 50 percent for both existing and future high velocity guns; continued development of high explosive 30mm cartridge for use in advanced guns capable of achieving velocities in excess of 5000 ft/sec; and completed initial evaluations of projectile control concepts applicable to guided projectiles for use with conventional tactical gun systems. FY 1985 efforts will: continue development of reactive kill mechanisms with preliminary designs of reactive/hypergolic fragment warhead designs; evaluate the interaction of large length to diameter heavy metal penetrator rods and advanced threat armors to aid design and development of effective warheads against Soviet T-80 and T-80 follow on tanks; apply the results of FY 1984 investigations of warhead jet formation to develop advanced jetting warhead designs that have increased penetration and lethality; based on FY 1984 investigations, initiate design of deep penetrating warhead for use against complex high value underground targets; continue development of enhanced blast mechanisms and incorporate promising concepts into deep penetrating warhead designs; establish feasibility of defense suppression submunition warhead designs in live arena tests and verify integrity of techniques for orientation and stabilization of submunitions during free flight; conduct high speed sled tests to verify structural integrity of depth of burial fuze and to verify fuze operations at desired deceleration and in target voids (technology will be transitioned into Advanced Development program for hard target weapon in FY 1986); establish feasibility of implementing optical sensor technology developed in FY 1984 in a multi-quadrant optical sensor utilizing common optics to obtain over 20 percent reduction in proximity fuze costs while obtaining the increased aerosol discrimination necessary for reliable all-weather operation; continue development of insensitive high explosives with primary emphasis on high energy plastic bonded explosive formulations and nitro-guanidine; conduct interim qualification tests of the extrusion cast system aimed at providing energetic binders to replace current inert binders to better couple explosive energy, pressure, and detonation velocity with the liner; complete projectile designs based on previous 6.2 effort for a base mounted electronic fuze for high velocity projectiles to overcome aerodynamic heating problems experienced with nose mounted fuzes at velocities over 5000 ft/sec; using results from FY 1984 effort, design and demonstrate potential life expectancy of barrel concepts incorporating advanced platings and innovative barrel designs and construction techniques; complete preliminary designs and experimental test and evaluation of high explosive 30mm, 5000 ft/sec ammunition for use in advanced guns. FY 1986 efforts will: initiate design and evaluation of air-to-air warhead incorporating the reactive kill mechanisms technology pursued during FY 1984 and FY 1985 (transition to Advanced Development in FY 1987 for potential incorporation as improvements in air-to-air missiles); continue development of large length to diameter heavy metal penetrating rods and transition promising concepts to industry (continuing in-house R&D, relies heavily on AF Materials Lab for materials research and manufacturing technology); conduct subscale and full-scale warhead case test and evaluation to verify designs for deep penetrating warheads for use against complex, hardened, high value underground targets; establish feasibility of defense suppression submunition sensor/fuze designs and develop preliminary designs for integration of the various defense suppression submunition components (designs will be provided to FY 1987 6.3 effort to develop and demonstrate through flight test); continue penetration fuze technology expanding upon FY 1985 work to obtain fuze capability to use in attack of highly complex buried command, control, and communication (C^3) sites for which no current capability exists (planned to transition in FY 1988); develop optical sensor algorithms for use in air-to-air proximity fuzes and design and fabricate optical fuze incorporating technology developed during FY 1984

and FY 1985 and these algorithms to achieve low cost all-weather optical proximity fuze for air-to-air missiles (test and evaluate in FY 1987 and transition technology to industry for potential application to advanced versions of medium range air-to-air missiles); continue development of high explosives using energetic binders, investigating new composite explosives with heavy metal oxidizers and newly synthesized organic compounds; conduct interim qualification test on insensitive high explosive formulations developed during FY 1985 (explosive development is continual effort coordinated with the Army and Navy and aimed at meeting future needs for improved high performance insensitive explosives) (work mostly in-house); and complete design and feasibility demonstration of variable electronic delay concepts for use with the base mounted fuze designed in FY 1985 which provides for optimum penetration necessary to achieve higher probability of kills against both air-to-air and air-to-surface targets.

C. (U) PROJECT: 2543, WEAPON EFFECTIVENESS METHODOLOGY. This project provides for the development and verification of models, computation techniques, and the data base necessary to assess weapon effectiveness against aircraft shelters, C^3 facilities, airfields, fortified targets, tanks, armored personnel carriers, aircraft, cruise missiles, and surface-to-air missile sites. Supports development planners, researchers, developers and operational forces. Achievements in FY 1984: continued computation, verification, and collection of weapons effectiveness indices, weapons characteristics, performance, delivery accuracy, aircraft carriage options and target information; developed the capability to prescribe optimal recovery procedures following an airbase attack and developed a three dimensional fragmentation model capable of depicting highly maneuverable out-of-plane exploding warheads; continued to update and derive computer models to support simulation of supersonic low altitude delivery of unguided weapons and to assess hazards of such delivery to the aircraft from its own weapons; developed physical and functional descriptions for the Soviet FULCRUM; completed physical and functional descriptions for assessing SA-5 site vulnerability; completed the advanced Soviet Infantry Fighting Vehicle physical model; prepared computerized geometric models for the T-80 tank, SA-6, SA-9 and command bunkers for use in vulnerability analysis; verified improved techniques for obtaining estimates of gunnery system accuracy; and initiated modeling of errors of aircraft avionics used in delivery of weapons and used the models to predict and compensate for weapon delivery errors. FY 1985 efforts will: improve penetration equations developed for use in aircraft vulnerability studies; prepared target descriptions for the FLANKER and Counter Air Fighter; complete vulnerability analysis of the Air Superiority Fighter; complete computerized geometric models of Advanced Infantry Fighting Vehicle, SA-8 and two C^3 vans; develop a combined effects model for assessing effectiveness of high explosive incendiary projectiles against aircraft; apply point burst methodology against bunker type targets to evaluate the effects of internal detonations; develop methodology and models for evaluating vulnerability of very hard C^3 targets; conduct feasibility analysis on mechanization of gunnery system accuracy measurement techniques for evaluating operational and conceptual guns and for potential application to combat simulations; and continue development of models of aircraft avionics errors for use in improving the delivery accuracy of weapons. FY 1986 efforts will: develop vulnerability models for the FLANKER and Counter Air Fighter using the target descriptions developed in FY 1985; develop physical and functional descriptions for the Peripheral Attack Aircraft, Peripheral Attack Bomber, and FENCER; conduct point burst effectiveness of submunitions against command, control, and communication vans, SA-8 and Advanced Infantry Fighting Vehicle using models developed in FY 1985; conduct component damage assessments against advanced composite airframe materials; develop functional and physical descriptions of the T-80 follow on tank; and conduct assessments of the degradation effects on Pacific theater targets after attack using the improved 2000 lb bomb.

D. (U) PROJECT: 2567, AEROMECHANICS TECHNOLOGY: This project develops weapon airframe and carriage technologies to reduce the aerodynamic performance compromise that results from burdening aircraft with weapons and will enable supersonic, low altitude weapon release, leading to greatly increased aircraft survivability. Provides technical analysis and evaluation capability to support all tactical and strategic air-launched munitions requirements including reduced structural limitations, stability and control problems, and drag and radar cross section penalties. Standardizes air-launched weapons interfaces with all aircraft which is an essential step for reducing costs, increasing maintainability and improving combat effectiveness. Satisfies the requirement for predicting the behavior of proposed aircraft weapon configurations and separations to provide safety and combat effectiveness. FY 1984 achievements: completed wind tunnel test and evaluation of advanced light weight, low drag, low observable weapon airframe designs aimed at reducing the performance compromise aircraft experience when loaded with weapons; initiated development of advanced aerodynamic submunition shapes and dispensing configurations that enable submunitions dispensed at supersonic speeds (Mach 1.2 to 3.0) to maintain their kinetic energy, stability and control during dispensing and through the supersonic flow field; initiated modification of analytical tools used to aid design, development and evaluation of dispenser weapon technology to enable analysis using advanced low drag, low observable weapon airframes and supersonic delivery; initiated brassboard development of an advanced hydraulically activated ejector mechanism based on designs evaluated in previous years for use in conformal, blended, semi-submerged and submerged carriage and release of weapons; initiated refinement of the fiber optic strain sensing technology developed in a FY 1984 6.1 effort; and initiated demonstration of the feasibility of using this technology in aircraft wing structures to obtain vibrational and strain information which can be used to correct for inertial navigation systems (INS) errors when aligning weapon INS to aircraft system; initiated cooperative effort with the Navy to develop and evaluate low cost optical inertial sensors capable of satisfying weapon inertial navigation, autopilot and heading and reference requirements for fast reaction, high reliability, long storage life, and lower total system costs; developed advanced high bandwidth signal switching techniques necessary to meet MIL-STD-1760 aircraft/weapon interface requirements that will reduce interface switching components cost by 20 percent and reduce switching network weight by 65% and can be implemented in volumes 90% smaller than current components; and established feasibility of using Ada programming language in tactical weapon guidance. FY 1985 efforts will: initiate a 6.2 Center of Excellence program in computational fluid dynamics (CFD) which will ultimately provide complete numerical solutions for air flow about weapons being carried on, or released from, advanced high performance aircraft; optimize dispenser type airframe designs (evaluated during FY 1984) and airframe material characteristics to obtain minimum drag, maximum lift, and minimum observables and evaluate these optimized designs in wind tunnel tests (designs will be provided as baseline for 6.3 Advanced Weapon Carriage Integration technology effort to build and flight test full-scale models of these airframes integrated with dispensing mechanisms and submunitions); identify submunition dispensing requirements and complete preliminary designs of small, light weight dispensing mechanisms with capability of supersonic dispensing from advanced low drag, low observable weapon airframes; conduct wind tunnel tests of selected submunition designs (being developed during FY 1984) to assess their performance characteristics during supersonic dispensing and free flight through supersonic flow fields and refine the designs for inclusion in the FY 1986 6.3 Advanced Weapon Carriage Integration Technology program; using missile type airframe designs from the FY 1984 effort, fabricate advanced light weight, low drag, low observable missile airframes and verify their structural integrity and performance in wind tunnel tests; complete modification of analytical tools initiated in FY 1984 and verify their usefulness in reducing the amount of costly flight tests necessary to evaluate

advanced concepts in submunition dispensing from low drag, low observable airframes at supersonic speeds; fabricate and begin test and evaluation of a brassboard hydraulic ejector mechanism that will enable conformal, blended, semi-submerged or submerged carriage and release of weapons thus reducing performance compromise of aircraft carrying weapons and reducing observables, thereby increasing delivery aircraft survivability; initiate development of ejection technologies, other than hydraulics, to ensure a strong technology base to support development of advanced low cost, low maintenance ejectors compatible with future aircraft; continue development of fiber optic structural dynamic sensor begun in FY 1984 for use in aligning weapon Inertial Navigation System to that of delivery aircraft; continue to develop low cost, highly reliable, rugged and small rotation sensors for use in tactical weapons; investigate quicker and more accurate transfer alignment methods for use in inertial navigation of tactical weapons; advance the state-of-art in bank-to-turn autopilots for use on advanced low drag airframes; develop improved guidance laws for both air-to-air and air-to-surface weapons; and pursue software engineering technology that will permit cost effective utilization of advanced digital processor technology. FY 1986 efforts will: fabricate breadboard dispensing mechanism based on designs from FY 1985 to evaluate their performance and compatibility with advanced low drag, low observable airframes and supersonic delivery in high speed sled tests (technology will be incorporated into 6.3 Advanced Weapon Carriage Integration effort to demonstrate dispensing of submunitions in flight tests); continue the FY 1985 effort to evaluate performance of light weight, low drag, low observable missile airframe by conducting captive and separation flight tests to characterize weapon airframe free flight performance (airframe designs will be incorporated into FY 1987 start of 6.3 effort for missile technology integration demonstration); complete evaluation of conformal hydraulic ejector and incorporate it into the 6.3 Advanced Dispenser Technology program for flight tests to demonstrate its potential for application to advanced aircraft; continue to develop stores ejection technologies to exploit their potential for low cost, high reliability, low maintenance blended and submerged carriage and release of weapons; continue Computational Fluid Dynamic research; fabricate and evaluate brassboard fiber optic structural dynamic sensors based on FY 1985 designs for use in aiding rapid (less than 5 sec) accurate transfer of alignment between weapon and aircraft INS to reduce initial misalignment in weapon guidance systems which currently are the dominant error source in weapon system INS; initiate study and analysis of potential weapon airframe materials and configuration for use in transatmospheric regimes (over 100,000 ft) (effort is coordinated with AF Materials Laboratory and will continue through FY 1987); develop a low cost guidance, navigation and control system for use in the demonstration of a light weight, low drag missile airframe; begin the development of very small, very low cost, solid state gyros and accelerometers; continue to evolve quicker, more efficient means of accomplishing transfer of alignment and calibration of tactical weapon inertial navigation systems; and begin a program to evaluate new and innovative inertial instruments; initiate the application of distributed system software techniques to tactical weapons.

E. (U) PROJECT: 2946, CHEMICAL WARFARE TECHNOLOGY. This project supports United States policy to deter enemy first use of chemical weapons by modernizing chemical systems to provide a credible and effective capability. Develops the DOD technology base for standoff air delivery of chemical agents including agent mixing techniques, dispenser and dispensing techniques, dissemination concepts, and effectiveness technologies. Provides threat assessment and target analysis and studies deployment concepts to achieve highest effectiveness (agent development is responsibility of the Army). FY 1984 achievements: initiated the re-establishment of an air launched chemical weapons technology base after ten years of dormant activity; initiated effort to postulate, study and evaluate advanced highly efficient concepts

for dissemination of chemical agents; initiated in-house effort to establish the necessary chemical agent data base documenting agent characteristics and parameters to be used in dissemination and delivery technology development (Effort is closely coordinated with Army.) FY 1985 efforts: initiate development and analysis of improved chemical weapons technology testing methodology that provides desired results within constraints of the open air test ban; initiate study and analysis of logistical implications of chemical weapons to ensure safety, handling and other logistical considerations can be designed into future weapons; continue development of dissemination concepts for various submunition configurations; initiate study and analysis of chemical weapon delivery technology to establish the feasibility of delivery scenerics and assess potential effectiveness of chemical weapons against variety of targets; and initiate study and analysis of using chemical agents for defeat of hardened targets. FY 1986 efforts will: continue analysis and evaluation of chemical weapons technology testing methodology working closely with the Army to identify nonlethal simulants that characterize lethal chemical agents; incorporate safety and other logistical considerations into component designs; continue development of dissemination concepts evaluating preliminary designs through breadboard test and evaluation (transition highest payoff approach to advanced development); continue evaluation of the delivery of chemical agent against a variety of targets, assessing tradeoffs between factors such as cost, environmental effects on delivery, safety to delivery aircraft, amount of agent to achieve desired results on selected targets and other factors effecting selection of chemical warhead delivery and effectiveness; and continue development of chemical weapons technology for use against hardened targets, evaluating preliminary designs of hard target chemical warheads.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986:

(U) PROJECT: 06AL, AIR FORCE ARMAMENT LABORATORY OPERATIONS.

A. (U) PROJECT DESCRIPTION: This project provides for the management and support of the Air Force Armament Laboratory, Eglin Air Force Base FL including pay of civilian scientists, engineers, and support personnel; travel; transportation; rents; communication costs; procurement of supplies and equipment and contractor support services. This project supports and complements all of the projects in this program element.

B. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE EFFORTS: Not applicable.

C. (U) MAJOR MILESTONES: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62702F — Title: Command, Control & Communications
DOD Mission Area: #521 - Electronic and Physical Sciences (ED) — Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		72,679	73,124	80,720	90,200	Continuing	N/A
06RA	Laboratory Operations	35,821	35,878	35,663	37,226		
2338	Assurance Techniques for Electronics	4,926	4,820	5,200	7,262		
4506	Surveillance Technology	7,708	7,639	10,910	12,445		
4519	Communications Technology	4,209	4,198	5,460	6,340		
4594	Intelligence Technology	5,936	6,164	6,755	7,765		
4600	Electromagnetic Radiation, Devices & Components	7,000	6,902	7,310	8,395		
5581	Command & Control Technology**	7,079	7,523	9,422	10,767		

* Excludes January 1985 Pay Raise (1,558)
** New Title, previously "Information Sciences Technology"

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This science and technology program provides a broad technology base for advancing Air Force mission capabilities in Command, Control, Communications and Intelligence (C^3I). C^3I is a composite of equipment and techniques enabling a commander to exercise continuous control of his forces in all situations. There are four functional areas within C^3I: command and control; surveillance; communications; and intelligence. Operational problems addressed in this PE include: improving the effectiveness and survivability of C^3I systems; obtaining reliable, secure communications; improving surveillance range and detection capabilities against new threats; improving the timeliness and quality of intelligence data and decision making; and increasing the availability of operational systems. Six basic technology areas are applied to these problems: electronic reliability and maintainability, electromagnetic compatibility; surveillance; communications; intelligence; electromagnetic radiation, devices and components; and information processing. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI). The program element also provides for management and support of the Rome Air Development Center (RADC), Griffiss AFB, Rome NY, and two divisions of RADC located at Hanscom AFB MA.

Program Element: #62702F
DOD Mission Area: #521 - Electronic and Physical Sciences (ED)

Title: Command, Control & Communications
Budget Activity: #1 - Technology Base

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	68,754	76,935	84,872		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Military Construction Funds	2,250	0	1,210	0	N/A	N/A

5. (U) RELATED ACTIVITIES: This program is actively coordinated at tri-service and interagency levels to preclude duplication and to meet overall Department of Defense (DoD) needs. Examples of this coordination are the DoD Advisory Group on Electronic Devices, the Interservice Antenna Group, and the Radiation Hardened Electronics Technology Coordinating Group. DoD has fostered close coordination between the Services in several technology areas affecting this program, particularly in the surveillance and communications areas. Space based radar surveillance programs are closely planned with the Navy and a joint agreement on technology efforts is in effect. A tri-service Fiber Optic Coordinating Group chartered by the Office of the Under Secretary of Defense for Research and Engineering (OUSDRE) coordinates all fiber optics R&D (6.1, 6.2 and 6.3) and implements joint programs (funding, technical effort and testing). Rome Air Development Center provides the principal Air Force member of this group. Image exploitation programs are coordinated through a national committee while the Defense Mapping Agency (DMA) coordinates all service programs in mapping and charting. The National Security Agency (NSA) coordinates all service programs in signals intelligence and the Defense Intelligence Agency (DIA) coordinates all work in intelligence data handling. NSA also coordinates all work in computer security. Major advanced development programs which receive direct transfers from this PE are: PE 63728F, Advanced Computer Technology; PE 63789F, Command, Control and Communications Advanced Development; PE 63726F, Fiber Optics Advanced Development; PE 63259F, Cartographic Applications for Tactical and Strategic Systems; and PE 63701B, DMA Advanced Development. Related non-Air Force programs are: PE 62725A, Computer and Information Sciences; PE 62721N, Command and Control Technology; and PE 62762N, Electronics Device Technology.

6. (U) WORK PERFORMED BY: The top five contractors are: IITRI, Chicago IL (Project 2338), Raytheon Co., Wayland MA (Project 4506), Rome Research Corp., New Hartford NY (Project 4519), RCA, Camden NJ (Project 4594), Honeywell, Inc., McLean VA (Project 5581). There were 98 other contractors with a total PE contractual funding of 31.4 million dollars in FY 84. The in-house work is performed by the Rome Air Development Center (RADC), Griffiss AFB NY, and two divisions at Hanscom AFB MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2338, Assurance Techniques for Electronics. This project provides technology in reliability and maintainability (R&M) techniques for electronics and in electromagnetic compatibility. Payoffs include lower life cycle costs; however, the critical factor is increased system availability. In the area of electromagnetic compatibility, smaller, densely packed components allow the integration of more radio frequency emitters in an aircraft, presenting severe interference problems. These technologies are transitioned directly to military specifications and standards and through support to system program offices. In FY 84, a study effort identified artificial intelligence applications to testability which promise to dramatically improve the maintainability of weapon system electronics through fewer false alarms and 100% fault isolation. A Reliability/Maintainability Technology Transition Fact Sheet was started to better transition technology and get feedback on RADC reliability and maintainability programs. Plans for FY 85 include the determination of the electromagnetic susceptibility of Monolithic Microwave Integrated Circuits (MMIC), an important new technology in advanced communications/radar equipment. Techniques will be developed to more accurately predict the reliability of systems which spend a large part of their life in a dormant state, i.e., storage. Reliability measures for customized devices manufactured in "silicon foundries" will also be developed. Since commercial "foundries" will have the capability of producing large numbers of custom circuits, reliability aspects must be investigated. Major goals for FY 86 include the development of cost effective techniques for designing reliability and maintainability into systems. Studies will concentrate on developing information that will enable testability to become an integral part of the microcircuit design process. In-depth reliability evaluations of MMICs will be conducted. Continued emphasis will be placed upon electromagnetic susceptibility characterization of selected Very High Speed Integrated Circuits (VHSIC).

B. (U) Project: 4519, Communications Technology. This project develops technologies which increase communication data rates, survivability and flexibility. For example, adaptive techniques should take the chance out of communication connectivity between users, making it more reliable. Another high payoff technology in this project is fiber optics. Although this technology is maturing in the commercial world, the Air Force has unique problems; for example, ruggedization and requirements for quick, reliable splicing. The payoffs are increased bandwidth, 10-to-1 reduction in deployment weight, and a 20-to-1 increase in transmission distance. Improved satellite communication technologies for global communications are also developed in this project. Since basic Air Force doctrine dictates centralized control and decentralized execution, effective and reliable communications are essential in waging war at any level. Also, since command, control, communications, and intelligence systems of the future will be more distributed for survivability, communication links between distributed elements will assume greater importance. In FY 84, signal processing subsystem designs for both airborne and space segments of the satellite communications program were completed. A long wavelength multiplexer (more than one wavelength of laser light propagating on the same fiber optic cable at the same time) and ruggedized fiber optic cable for wideband data remoting were completed. Low probability of intercept (LPI) techniques to improve protection and connectivity of high frequency radio networks were developed. In FY 85, the wavelength division multiplexer will be expanded to 12 wavelengths for fiber optic communication applications. This will dramatically increase the information transfer capability of a single fiber optic cable. A ruggedized fiber optic cable

for remoting will be completed. Extremely high speed signal processing efforts will be initiated using digital (systolic architectures) and optical processing technologies. Major milestones for FY 86 include the demonstration of a wideband high frequency communication capability which will provide long range, covert communications for tactical and strategic forces, and the initiation of a study effort investigating new frequency bands for satellite communications. Emphasis in the fiber optics communications program will be on millimeter wave links to overcome deployment limitations due to inflexibility of waveguide and metallic coaxial cable. A 50-to-1 improvement in link length may be possible allowing more options in "distributing" C^3I systems for increased survivability. The design of a multiple media local area network (LAN) capability will be completed and transitioned to advanced development. This will allow each node in an LAN to communicate with all other nodes over a mixture of cable, radio, and other paths for topology independence and increased survivability, flexibility, and interoperability.

C. (U) Project 4594, Intelligence Technology. The purpose of this project is to develop technologies required to improve and automate the Air Force capability to provide useful and timely intelligence information from all sources. Improved data recording and handling techniques are required for rapid processing, storage, and dissemination of extremely high data rate, large volume digital information. Technology to provide speech recognition for voice input used in entry control and computer control is developed. Near real time target classification and multisensor correlation techniques are developed to increase the quality and timeliness of military intelligence. New and improved cartographic and photogrammetric methods and equipment are developed for the production and utilization of digital data bases to support future weapon systems and the Defense Mapping Agency (DMA). Image processing technologies, essential for the extraction of intelligence information from a variety of imaging sensors, are also developed in this project. In FY 84, a speaker independent speech recognition capability with an increased vocabulary was developed. Artificial intelligence techniques for predicting airfield activity and image analysis were investigated. Plans for FY 85 include the testing of an optical disk recorder used for a variety of applications requiring large storage capacities. Efforts to demonstrate and prove application feasibility of knowledge based systems to aid the intelligence analytical process will continue. In addition, these efforts will increase the utility and responsiveness of data base management systems as they relate to C^3I functions. Efforts will also continue in speech processing technology for critical C^3I needs for both ground and airborne applications such as jam-resistant, narrowband communications; voice control; voice data entry; and speech enhancement. In FY 86, the optical disk concept will be extended to accommodate throughput rates and storage densities commensurate with fifth generation computers. Artificial intelligence tools (diagnosis, explanation techniques and natural language processing) will be applied to intelligence message analysis/generation problems. Imagery exploitation technology will continue with emphasis on deriving maximum intelligence utility from sensor, collection and data link advances.

D. (U) Project: 4600, Electromagnetic Radiation, Devices and Components. This project provides the Air Force with a strong technology base in devices and techniques for the exploitation of electromagnetic radiation in C^3I. Principal areas of activity are: antennas and radio frequency components; electromagnetic scattering; propagation; electromagnetic materials; advanced solid state devices and circuits; electro-optical devices; and radiation hardening.

The antenna, component, and propagation technologies provide methods for increasing anti-jam capabilities and survivability. This project develops the fiber optics devices and cable technologies for the fiber optics effort in Project 4519. The electromagnetic materials and devices technologies provide faster, cheaper, and much smaller components for such critical missions as radar and communications signal processing and frequency standard subsystems. Improved frequency standards are essential to meet the sophisticated timing requirements of advanced communications systems. Radiation hardening ensures C^3 mission accomplishment in nuclear and space environments. The electromagnetic scattering effort in this project supports the low observable work in Project 4506 with radar cross section (RCS) research directed at both low RCS antennas and targets. In FY 84, the radiation testing of heavy metal fluoride glass optical fibers was completed. This new optical fiber offers the potential of extremely low loss propagation and increased radiation hardness. Testing was accomplished on antennas mounted in simulated aircraft structures to determine the RCS. In FY 85, small sub-sections of a fully monolithic, active, conformal array at frequencies of 20 and 44 GHz will be developed. This is a significant technological breakthrough allowing flush mounted, small antennas for the B-1B and Advanced Tactical Fighter for satellite communications. This, in turn, provides less drag and better stealth properties. Radiation hardening of metal oxide semiconductor field effect transistor technology will be developed through a new technique of dielectric isolation. An infrared camera using a platinum silicide focal plane array with a temperature resolution goal of 0.01 degrees Kelvin will be built and demonstrated in-house. In FY 86, propagation efforts will develop adaptive communications to improve connectivity and endurance. Scattering technology will focus on low RCS antennas. Fiber optics multiplexers and ruggedized connectors will be completed for transition to advanced development. Antenna developments will be emphasized for satellite communications and next generation radars. Components for new frequency standard clocks will transition to advanced development.

E. (U) Project: 5581, Command and Control Technology. The purpose of this project, previously titled Information Sciences Technology, is to develop technologies which advance Air Force capabilities in the command and control functional area of C^3I. Command and control is vitally dependent upon information processing and the suitable presentation of information to commanders. Accordingly, the primary technology areas addressed in this project include: software development and engineering, since software is the primary tool for processing information; artificial intelligence, including expert system decision aids; and distributed processing for survivability. Software development has become one of the most costly items in weapon systems and is becoming more costly because of complexity and rising labor costs. A major thrust of this project is to develop technologies to evolve software development, acquisition, and support into a more disciplined process to reduce costs associated with all life cycle phases. The artificial intelligence technology developed in this project supports both the software development effort and decision aids. These aids are essential in helping decision makers in time critical, stressful situations where human information processing capacities are overloaded. In FY 84, a consortium of universities was organized to address basic technology needs in artificial intelligence in this project and for Projects 2338 and 4594. Architectures (system design configurations) were developed to integrate C^3 countermeasures (C^3CM) into command and control structures. New decision aids were demonstrated to assist in the selection of optimum C^3CM. In FY 85, technology for C^3I software engineering environments, Ada software testing and very high level languages will be developed. Artifi-

cial intelligence techniques for knowledge based software assistance in the software life cycle will be investigated. The development of decision aids for automating certain functions in current command and control systems, aids for battle staffs, and for mission planning will continue. Distributed processing techniques applicable to survivable local area networks will be pursued. Command and control simulation capabilities will be established to evaluate prototype decision aids in the R&D development stage. FY 86 plans call for the continued production and evaluation of command and control decision aids for the tactical commander. Field commanders will be used in the testing and validation process. Software engineering will pursue a new generation of testing methods for Ada and software life cycle cost analyses. Artificial intelligence technology will address knowledge based planning in a distributed environment. Computer security will be considered from the standpoint of improved data base and distributed operating system security.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06RA, Laboratory Operations.

A. (U) Project Description: This project funds support activities required to operate Rome Air Development Center (RADC), Griffiss AFB NY, and two divisions of RADC located at Hanscom AFB MA. Support provided includes the pay and related costs of civilian scientists, engineers, and supporting personnel, travel, transportation, rents, communications, utility costs, procurement of supplies and equipment, and contractor support services. In addition to the exploratory development work described above, RADC is responsible for technology intensive engineering development programs, primarily in the intelligence area. RADC also provides technical support to system program offices.

B. (U) Program Accomplishments and Future Efforts: Not Applicable

C. (U) Major Milestones: Not Applicable

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 4506, Surveillance Technology.

A. (U) Project Description: The purpose of this project is to develop advanced ground, airborne, and space based system concepts and the technology required for future Air Force surveillance missions. Major thrusts include: development of technology for new surveillance radars; surveillance technology for low observable threats; and survivability technologies for surveillance systems. Positive identification by other than visual means is a high priority requirement and new technologies are being pursued to solve this problem. A jam-resistant, space based radar with the capability to detect and track 1990s type threats is based on the signal processing, array antenna techniques

and solid state Transmit/Receive (TR) modules developed in this project. Solid state TR modules using monolithic microwave integrated circuits (MMIC) are being developed to improve performance and reliability and reduce size and weight. Microwave tubes for satellite communication airborne terminals and satellites are also developed. Future threats with reduced radar cross sections (stealth) and increased enemy jamming capabilities will require the technologies developed here to successfully accomplish the Air Force surveillance mission.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: In FY 84, as part of the space based radar technology effort, 200 phase-shift only modules were delivered and successfully tested. Preliminary testing on breadboard Monolithic Microwave Integrated Circuit (MMIC) transmit/receive modules began and 6.3 transition programs in modules were initiated. Conformal array radar technology is transitioning into advanced development. The conformal array antenna is flush with the aircraft fuselage, allowing a much larger antenna aperture than the Airborne Warning and Control System (AWACS) rotodome antenna. Larger antenna apertures allow the radar to detect low observable threats.

(2) (U) FY 1985 Program: Major goals for FY 85 include the completion of a section of a conformal array antenna using MMIC modules. Digital beam forming technology will be initiated for application to surveillance radars. This technology holds the promise of dramatic improvement in antenna electronic counter-countermeasures performance by bringing the digital world, and consequently flexibility, to phased array antennas. Satellite communications tube development will continue with emphasis on higher frequencies, reliability, and lower cost. In particular, traveling wave tubes will be developed for operation at 60GHz for secure satellite links since this frequency does not propagate through the atmosphere.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 funding in this project will support approximately 80 individual contractual and in-house efforts in the following technology areas: space based radar; low observable (cruise missile) surveillance; advanced airborne surveillance radar (next generation AWACS, Airborne Warning and Control System); surveillance internetting/identification; advanced tube technology; monolithic microwave integrated circuits; and signal processing technology for radar. The funding is divided into three categories: direct project support (10% of project funding) includes travel costs, equipment purchases and in-house research expenses directly related to the project; on-going contractual efforts (60% of project funding, 56 efforts); and new start contractual efforts (30% of project funding, 25 efforts). The majority of the contractual efforts are firm fixed price with an average duration of about 24 months. In the space based radar technology area in FY 86, testing will be completed for the phased array lens demonstration utilizing 500 phase-shift only, solid state transmit/receive (TR) modules. A deployment of the antenna lens membrane will also be demonstrated. A two feet by two feet section of the lens membrane will be prepared for launch on the Space Shuttle to test the article in a space environment. In the low observable (cruise missile) surveillance technology area in FY 86, modeling validation will be completed for both metallic and non-metallic targets. Development will continue on hybrid passive/active system concepts

and multistatic surveillance technologies (both cooperative and non-cooperative). An effort will be initiated to develop a bistatic radar receiver using digital beamforming to accomplish nulling and multiple receive beams with the potential for enhanced target detection. In the advanced airborne surveillance radar technology area in FY 86, both bistatic radar and moderate bandwidth detection experiments will be conducted. A new start contract in FY 86 will investigate constant false alarm rate processing algorithms. In the surveillance internetting/identification technology area, surveillance network/operator interface development will continue. In the advanced tube technology area in FY 86, new contract starts include the development of a 94 GHz traveling wave tube and a 2 kilowatt, 44 GHz amplifier. In the monolithic microwave integrated circuit technology area in FY 86, a new start contract will develop a solid state, transmit/receive module which will operate in two different frequency bands to provide protection against jammers. In addition, signal interfaces will be integrated with modules. In-house evaluation of selected modules will continue. In the signal processing technology area in FY 86, an ultra fast signal processor utilizing a systolic architecture will be demonstrated. Development will continue on a VHSIC (Very High Speed Integrated Circuit) signal processor brassboard for insertion into the Airborne Warning and Control System (AWACS) for improved radar signal processing capabilities.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62703F
DOD Mission Area: #522 - Environmental and Life Sciences (ED)

Title: Personnel Utilization Technology
Budget Activity: #1 - Technology Base

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		7,080	7,829	9,421	10,543	Continuing	N/A
06HP	Laboratory Support	4,139	4,186	4,119	4,287		
7719	Force Acquisition and Distribution System	2,435	2,334	3,477	4,206		
7734	Force Management System	506	1,309	1,825	2,050		

* Excludes January 1985 civilian payraise (146).

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force requires a continuing supply of quality personnel who can operate and maintain sophisticated weapon and support systems. This manpower and personnel research program incorporates two interrelated streams of research designed to address the problems involved in acquiring and maintaining a quality force by developing technology to enhance the selection, assignment, training, and retention of that force. The two streams of research are the Force Acquisition and Distribution System, and the Force Management System. Included in the Force Acquisition and Distribution System are efforts to (a) develop and validate personnel testing procedures, (b) determine and measure specific requirements for Air Force jobs, and (c) improve the process for matching individuals to jobs. The Force Management System will provide (a) the means to measure and evaluate job performance and link enlistment standards to on-the-job performance, (b) automated procedures to address fundamental training management issues, (c) models and strategies to improve retention, and (d) comprehensive skills management and reenlistment/career assignment programs. This is a Science and Technology program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	6,950	8,829	10,049

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Related PEs are 61102F, Defense Research Sciences; 62763N, Personnel and Training Technology; 63707N, Manpower Control System Development; 62717A, Human Performance Effectiveness and Simulation; 63731A, Manpower & Personnel; 62205F, Training and Simulation Technology; and 63704F, Manpower and Personnel Systems

Technology. Air Force efforts directed toward improvement of the Armed Services Vocational Aptitude Battery (ASVAB) and the production of new forms of that test are directed, in part, by a tri-service steering committee of General Officers. Similarly, efforts concerned with the development of computerized testing techniques for eventual implementation at Military Enlistment Processing Stations are coordinated with the other Services. Air Force responsibilities lie principally in the development of test items suitable for computer implementation. Efforts across all Services to develop job performance measures are coordinated by a working group monitored by the Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics (OASD (MI&L)). Close coordination is maintained both at the working level and by laboratory management with other Services. Exchange of proposed statements of work for contractual efforts, wide dissemination of technical reports, and symposia and meetings attempt to ensure that work conducted within this program element benefits from and does not duplicate work conducted by the other Service laboratories.

6. (U) WORK PERFORMED BY: Contractors are: The Maxima Corp, Bethesda, MD (7719 and 7734); Resource Research Corp, College Station, TX (7719); Old Dominion University, Norfolk, VA (7719); Advanced Research Resources, Bethesda, MD (7719); and McDonnell Douglas, St Louis, MO (7719). There are fourteen additional contractors ($1,578 thousand). This program is managed by the Air Force Human Resources Laboratory's Manpower and Personnel Division (AFHRL/MO), Brooks AFB, TX.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 06HP, Laboratory Support. This project provides for that part of the operating costs of the AFHRL that support personnel utilization technology exploratory development and includes pay and related costs of civilian scientists and support personnel, transportation, rents, communications, utility costs, supplies, equipment, and contractor services. PE 62205F, Training and Simulation Technology, provides the remainder of the support for AFHRL exploratory development.

B. (U) Project: 7719, Force Acquisition and Distribution System. This project provides the research and development of personnel qualification and aptitude tests, job specification standards, and manpower and personnel models to ensure the Air Force recruits, selects, classifies, and assigns the best qualified individuals. The Air Force is the DOD Executive Agent for the Armed Services Vocational Aptitude Battery (ASVAB) which is used by all the Services for selection and classification of enlisted members. It is used for screening over 200 thousand Air Force recruits annually. Use of the ASVAB results in reduced attrition from training and improved retention and skill upgrading as well as better person-job matching. This results in a cost avoidance of $37 million a year for the Air Force and $180 million DOD-wide. In FY 1984, calibrated item pools for converting the ASVAB to a computer adaptive test system were completed and four new versions of the ASVAB were fielded. A large effort to determine the basic skills requirements of Air Force jobs and the functional skills of individuals was begun in FY 1984 and will provide technologies for transition to Project 2949, Basic Skills Assessment and Enhancement System, in PE 63704F, Manpower and Personnel Systems Technology. This effort will enhance combat readiness by ensuring Air Force personnel have the skills necessary to perform successfully in peacetime and combat. Research in FY 1985 will continue to provide the

technology base for the Armed Services Vocational Aptitude Battery (ASVAB) and the Air Force Officer Qualifying Test (AFOQT) as well as improved combat/disaster preparedness and contingency training. Also in FY 1985, the methodology will be developed for managing training policy and assessing the impact on technical training resulting from changes in airman specialty requirements. A new rated selection system which includes perceptual and psychomotor measures will be completed and should significantly reduce attrition from pilot training and provide more highly skilled pilots in the field. Continuing evaluations of the impact that changes in aptitude and physical requirements will have on procurement, force manning, recruiting, and training systems will be accomplished in FY 1986. Also in FY 1986, validation of the Air Force Reserve Officer Training Corps (AFROTC) and Air Force Officer Training School (OTS) selection systems will be accomplished, and a screening system for missile launch officers will be developed. Examinations of job characteristics and requirements and the relation of those parameters to the characteristics and abilities of successful and unsuccessful job incumbents will be assessed to properly place individuals in jobs that suit their abilities. Job/task requirements will be related to the abilities of incoming personnel and will lead to improved matching of Air Force personnel to jobs which most closely relate to their aptitudes, interests, and skills. Person-Job-Matching will be expanded from the current use as a first assignment tool to assignments throughout enlisted members' careers. Continuing emphasis will be placed on research to improve selection of pilot trainees, the subsequent assignment of pilots to specialized training tracks, and the evaluation of combat aircrew job performance. During FY 1986, task demands in air combat will be determined, characteristics of successful fighter pilots will be identified, and specialized tests for classification of pilots will be validated. This research will lead to improved air-combat performance, and a reduction in pilot training attrition resulting in significant cost and resource savings.

C. (U) Project: 7734, Force Management System. The Air Force needs to develop strategies and techniques which will improve the personnel management and retention of qualified personnel in order to make the most effective use of assigned personnel and to compete with the private sector for a shrinking pool of such qualified personnel. Also the Air Force must satisfy a Congressional mandate to link enlistment standards and selection methods to on-the-job performance measures. In FY 1984, initial collection of enlisted job performance measures was undertaken. Also, research was initiated to cluster Air Force job tasks into skill groupings for determining which tasks should be trained in resident schools vs field unit settings. This data will support the development of a Training Decisions Systems which will provide Air Force policy and decision makers revelant data before making significant training decisions. Retention factors which will lead to improved selection systems will be identified and measures of individual and organizational productivity will be developed in FY 1984 as well. This is in direct response to the FY 1984 Authorization Bill language which directs the development of models and procedures to enhance retention of Air Force personnel. In FY 1985, the development of task-level job performance measurement techniques will continue with the development of a prototype performance test to allow the Air Force to validate selection and classification standards. The Congressional mandate to link enlistment standards to on-the-job performance measures has resulted in monitoring of this effort by the Office of the Assistant Secretary of Defense for Manpower, Installations, and Logistics. In FY 1986, a means for modeling optional patterns of jobs and assignments will be completed and transitioned to Project 2951, Training Decisions System, in PE 63704F, Manpower and Personnel Systems Technology. In FY 1986, exploratory development and validation studies will continue to identify personnel and occupational factors related to attrition/retention problems and develop reliable and valid measurement techniques for collecting such

information. Also during FY 1986, practical manuals for enhancing organizational productivity and methodologies for assessing the improvement in organizational effectiveness and efficiency will be completed. In FY 1986, skill transfer indices will be developed to estimate the ease with which an airman can be transferred from one career specialty to another. Currently, little information is available about the similarity of work requirements (skills/knowledges and experiences) between specialties. This new technology will provide procedures for describing similarities among Air Force jobs and accounting for both the capabilities and service experience of the individual as well as the skill/knowledge requirements of the new job. The capability to select, assign, and train personnel to increase the probability of job success will maximize the payoff from manpower dollars and increase Air Force combat effectiveness.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63106F Title: Logistics Systems Technology
DOD Mission Area: #553 - Engineering Technology (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,985	5,248	12,736	21,859	Continuing	N/A
2744	Unified Data Base (UDB) for Acquisition Logistics	*	*	1,500	2,000	1,500	7,800
2745	Logistics for Combat Readiness Maintenance	*	*	1,016	1,226	15,643	17,885
2940	Computer Technology for Systems Design and Maintenance	2,985	5,148	4,800	4,900	Continuing	N/A
2950	Integrated Maintenance Information System (IMIS)	0	0	1,200	4,500	Continuing	N/A
3026	Logistics Command, Control, Communications and Intelligence	0	100	**	**	**	**
3203	Integrated Maintenance Information System for PAVE SPRINTER	0	0	1,000	4,200	6,000	11,200
3204	Reliability and Maintainability Design and Analysis	0	0	1,500	1,500	Continuing	N/A
3205	Logistics Expert System	0	0	1,720	3,533	Continuing	N/A

* Previous funding for this project is contained in Program Element 63751F
** Outyear funding for this project is contained in Program Element 78031F

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: DOD Defense Guidance, OSD funding initiatives over the last two years, and a recent memorandum from Secretary Orr and General Gabriel have emphasized the need to improve the reliability, maintainability, and combat supportability of Air Force weapons systems. The logistics systems technology program, part of the Air Force Science and Technology program, will develop and demonstrate: (a) new, computer-based technologies that will enable more reliable, maintainable, and testable weapon systems to be designed; (b) procedures and tools to develop and predict the logistics support required to efficiently operate aircraft maintenance organizations during wartime conditions; and (c) a light weight, rugged, compact, portable computer and display system for the flightline technician which provides access to automated technical orders, integrated diagnostics,

maintenance management, and computer based training; and (d) intelligent decision aids for spares provisioning, purchasing, and management functions in Air Logistics Centers.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	2,985	5,248	4,810		Continuing	N/A

The title of PE 63106F was officially changed from Logistics Research and Development Requirements to Logistics Systems Technology during FY 1984. The FY 1985 Descriptive Summary estimate for FY 1986 was increased by $8,200 thousand in the preparation of the FY 1986 budget. The increase was, in part, the result of realigning Project 2744, Unified Data Base for Acquisition Logistics and Project 2745, Logistics for Combat Readiness Maintenance, from Program Element 63751F, Training Systems Technology, to Program Element 63106F, Logistics Systems Technology. This realignment consolidates generic advanced technology development for logistics into one program element. The balance of the FY 1986 increase was to start work on Project 2950, Integrated Maintenance Information System for PAVE SPRINTER, and Project 3205, Logistics Expert System. The project on Dormant Reliability Technology Development, mentioned in previous Descriptive Summaries, has been cancelled as a separate effort. That work will be incorporated within the new Project 3204, Reliability and Maintainability Design Analysis, in FY 86.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: PE 62201F/Project 2401 Aerospace Flight Dynamics/ Integrated Design System provided feasibility demonstration for Project 2940, Task 02, Integrated Design Support (IDS) system. PE 78011F, Manufacturing Technology/Integrated Computer Aided Manufacturing, is providing analysis methodology and software for graphics transmission and reception to Project 2940, Task 02, IDS, and to Project 3205, Logistics Expert System. PE 63751F/Project 2362, Training Systems Technology/Computer Based Maintenance Aids for Technicians, provides for a specification on how to optimally present tech data on an electronic display for Project 2950, Integrated Maintenance Information System (IMIS). US Army PE 64722A/Project 2790 Education and Training Systems/Personal Electronic Aid for Maintenance (PEAM), is developing a technical data authoring system that will be used for Project 2950, IMIS. US Navy PE 63721N, Integrated Diagnostics Support System, is developing artificial intelligence technology which will be used in further development of Project 2950, IMIS. PE 63253F, Avionics Systems Integration Demonstration, and Project 3203, Integrated Maintenance Information System for PAVE SPRINTER, are both parts of a joint development and demonstration of an interactive diagnostic and maintenance aiding system for Very High Speed Integrated Circuit (VHSIC) avionics. PE 63244F/Project 2899, Aircraft Battle Damage Repair (ABDR), is supplying data for ABDR requirements into Project 2745, Logistics for Combat

Maintenance Readiness. Model development is being done jointly for both projects. PE 62205F/Project 1710, Training and Simulation Technology/Logistics and Maintenance Technology, provided feasibility demonstration and baseline software for Project 2744, Unified Data Base for Acquisition Logistics. The same project will provide preliminary maintenance technician task guidelines under a chemical warfare environment, and modeling of wartime demand for electronic warfare equipment to Project 2745. This same PE 62205F/Project 1710 will provide a prototype computer graphics model of a maintenance technician to enable Maintainability Analysis as part of Project 2940, Task 01, Maintenance and Logistics Factors in Computer Aided Design. Project 3204, Reliability and Maintainability Design and Analysis, will exploit dormant reliability assessment methods developed by Rome Air Development Center under PE 62702F, Command, Control, and Communications. Service/Agency Coordination is demonstrated by continuing interface and close coordination among the Army, Navy, and Air Force on Logistics research and development being conducted by other Department of Defense, National Aeronautics and Space Administration, and industrial organizations to eliminate redundancy. The Computer aided design (CAD) efforts have been coordinated with the NASA Integrated Program for Aerospace Design (IPAD) and with the Department of Defense Manufacturing Technology Advisory Group (DODMTAG) through membership on their CAD/CAM (Computer Aided Manufacturing) subcommittee. The CAD efforts are fully coordinated with the Integrated Computer Aided Manufacturing (ICAM) Program being accomplished under PE 78011F, Manufacturing Technology/Integrated Computer Aided Manufacturing.

6. (U) WORK PERFORMED BY: Primary contractors doing work funded by PE 63106F: (1) North American Rockwell, Los Angeles, CA, on Project 2940, Task 02, Integrated Design Support; (2) General Dynamics, Fort Worth, TX, and San Diego, CA, on Project 2940, Task 01, Maintenance and Logistics Factors in Computer Aided Design; (3) Perceptronics, Woodland Hills, CA, on Project 2745, Logistics for Combat Readiness Maintenance; (4) Systems and Applied Sciences Corp., Vienna, VA, on Project 2744, Unified Data Base for Acquisition Logistics. Total contract value in FY 1986 is planned to be $10,140 thousand. Contractors for Project 2950, IMIS, and companion Project 3203, IMIS for PAVE SPRINTER, will be selected in FY 1986. This program element is managed by the Air Force Human Resources Laboratory (AFHRL), Brooks AFB, TX through the Logistics and Human Factors Division, Wright-Patterson AFB, OH, and by the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, OH. The development tasks require multi-laboratory efforts with specific laboratory involvements varying from one year to the next.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2744 Unified Data Base (UDB) for Acquisition Logistics. Engineers and managers responsible for producing supported weapons systems have a common need for logistics data on current weapon systems which can be used and modified in building new weapon systems. Currently, logisticians, managers and engineers must use data bases which have different formats, and specialized applications, which are difficult to change, and which require highly developed skills for comprehensive logistic support planning. This project is developing and demonstrating software and a computer architecture to allow Air Force and contractor program offices to interactively access, analyze, and generate logistics related data from a unified data base (UDB). The data base will contain design, engineering,

logistics planning, and personnel factors needed to accomplish logistics support analysis necessary in the life cycle of a weapons/support system. The UDB and its integrated computer architecture will be easy to use and conform to the human factors needs of the users. An important innovation will be the capability to use the UDB to process feedback data from weapon system test and operation. This will provide weapon system designers access to current logistics data during planning and acquisition of weapon systems. The software developed under PE 62205F/Project 1710, Training and Simulation Technology/Weapons System Logistics and Combat Maintenance, to structure and manipulate a UDB, was installed at Wright-Patterson AFB, OH and tailored in FY 1985 for testing in weapon systems in development. In FY 1986, integration with Project 2940 IDS, demonstration testing, and evaluation of the UDB by Air Force organizations involved in system test, development and support for various weapon/support systems will be initiated. Future efforts will result in the completion of testing, evaluation, and feedback to improve the UDB and the completion of specifications necessary for technology transition to other weapon/support system development programs.

B. (U) Project: 2745, Logistics for Combat Readiness Maintenance. The Air Force needs to predict demands for tactical aircraft maintenance in deployed wartime conditions. Aircraft battle damage, intense operational use of electronic warfare systems and pods, and consumption of droppable fuel tanks which are replaced by tanks built up in the field, create wartime demands for maintenance and skills which are not seen in peacetime. Given these demands, there are models such as Dyna-Metric and Logistics Composite Model (LCOM) which will output the sortie generation potential and the number of maintenance personnel required for a campaign. At present there are no satisfactory analytical tools or procedures to determine the changes in demand on the aircraft maintenance system from peacetime to wartime. Based on studies of recent wartime data carried out under PE 62205F/Project 1710, Training and Simulation Technology/Weapons Systems Logistics and Combat Maintenance, PE 63244F/Project 2899, Aircraft Battle Damage Repair, and this project, extrapolation of peacetime data is not realistic. Project 2745 is developing data bases and methods that will generate valid inputs to Dyna-Metric and LCOM for wartime conditions. Through analysis of actual wartime data, Project 2745 will identify the factors that drive demands for maintenance in combat. The computer simulation models and other analytical tools developed in this project will be specified and documented to enable eventual transition to operational and staff logistics planners to assess potential combat capability and sustainability for tactical aircraft units. In FY 1984, pertinent historical combat logistics data was acquired. In FY 1985, additional data is being gathered and work initiated on modeling the critical requirements for successful accomplishment of the war zone tactical aircraft maintenance mission. During FY 1986 the prediction techniques will be tested and evaluated in simulation models to assess their utility and power. Simulation models will be used to examine and evaluate the transition from peacetime to wartime operations and identify the extra training needed for projected wartime requirements. In the future, the second phase of this project will field test techniques and methods for performing maintenance in a chemical/biological warfare environment that were developed in supporting exploratory development work.

C. (U) Project: 2940, Computer Technology for Systems Design and Maintenance. DOD and the Air Force are placing more and more emphasis on achieving highly reliable, easily maintained, affordable systems which give nothing away in mission performance. Reliability, maintainability, and testability (R,M&T) are engineering characteristics which can

and must be designed into a system, from the start. The goal of this project is to develop, demonstrate, document and specify computer aided design technology to improve weapon system design and maintenance. The project consists of two interrelated tasks. The first task, Maintenance and Logistics in Computer Aided Design, will enable contractors to more effectively design required R,M&T characteristics into a weapons/support system and reduce support complexity, and requirements for skilled maintenance personnel. Currently, designers of weapons systems do not have easily used, effective methods to consider reliability, maintainability, and testability (R,M&T) impacts of hardware design alternatives during early design stages. Computer aided design techniques can be augmented and modified, making it possible to implement logistics and R,M&T considerations during initial design phases. R,M&T data are available to assist the designer. However, in their present paper form, without computerized formats, they are neither accessible nor manageable. The Maintenance and Logistics in Computer Aided Design (MLCAD) task is a two phased effort. The first phase includes three, short-term, high payoff demonstrations to develop hard evidence of the benefits of using CAD to address supportability. The demonstrations involve subsystems for the Ground Launched Cruise Missile and the F-15 and F-16 aircraft. The second phase develops a prototype MLCAD system to serve as a standard for industry. This prototype will be the basis for standards throughout DOD and industry to insure that reliability, maintainability, and testability are incorporated into weapon system design up front while the design is still fluid. The Institute for Defense Analysis is conducting a planning effort in conjunction with the National Security Industrial Association to specify requirements for the prototype development. In FY 1984 work began on developing analytical models, computer software, data bases, and work procedures for including maintenance and logistics factors in the computer design of systems and equipment. Work also began on the initial demonstration to redesign the armored enclosure for the turbine powered generator on the Ground Launched Cruise Missile Transporter Erector Launcher to solve a thermally induced reliability problem. During FY 1985, work will continue on the final definition of the overall complement of MLCAD technologies. The three short-term demonstrations will be completed to provide evidence that system supportability will be enhanced via CAD. In FY 1986, the development, adaptation and testing of software to meet requirements identified as lacking in the demonstrations will be completed. In the future, work will continue on the development and demonstration of additional MLCAD capabilities with high payoff, including the use of a computer graphics model of a maintenance technician, to check accessibility and other human factors considerations in maintainability design. The second major task, the Integrated Design Support (IDS) system will provide specifications, standards, and software to enable the Air Force to electronically access a contractor's weapon system data base, as well as enable exchange of engineering data between prime contractors and subcontractors. Currently, the Air Force cannot easily communicate or use the computerized design data which are produced by most contractors during weapons system design, though the Air Force Logistics Command's Engineering Data Capture and Retrieval System (EDCARS) is developing ways to go from paper and microfilm engineering drawings (furnished by the contractor) to digitized, electronic data. Industry moved rapidly into computer aided design systems, yet the Air Force cannot communicate directly with these systems for coordination purposes or save this highly valuable data except initially on paper or microfilm for subsequent logistics, maintenance, remanufacturing or engineering data needs. This project defines the specific engineering data base required by the Air Force and develops the software architecture required for interactive communication and archival storage of digitized engineering data. In FY 1984, work began on the development of a system architecture and engineering data base design

for the storage and retrieval of aircraft design considerations, design specifications, manufacturing methods, and fabrication maintenance instructions. The B-1B weapon system was identified for demonstrating the IDS technology in the area of aircraft structures. In FY 1985, the initial system architecture and engineering data base design is being completed. During FY 1986, development will begin on the interface required for communication between the several computer aided design (CAD) systems currently used by industry. Additional work on the interface for engineering analysis models developed in the Maintenance and Logistics in Computer Aided Design (MLCAD) task will begin. Work on the communications capabilities, the user interface, and the applications interface specifications and standard for the IDS system will be initiated. In the future, work will continue toward tying in Maintenance and Logistics in Computer Aided Design (MLCAD, Project 2940, Task 01) and Unified Data Base (UDB) for Acquisition Logistics (Project 2744) into the Integrated Design Support (IDS) system and demonstrating IDS technology. The final specification and demonstrations will encompass design, manufacturing and logistics integration into the IDS system. The payoff will be a shorter and less costly development cycle with vastly reduced costs for technical data delivery.

D. (U) Project: 2950, Integrated Maintenance Information System. This program is an FY 1986 new start. The Integrated Maintenance Information System (IMIS) will demonstrate a highly portable computer and display interface (terminal) for the maintenance technician on the flightline. This terminal will demonstrate a single gateway for automated technical orders, integrated diagnostics, maintenance management, and computer based training. When fully developed and ruggedized, the IMIS terminal and software will permit fewer people to perform a wide range of maintenance in the deployed tactical environment of the future. In FY 1986, a requirements analysis and initial design of the software architecture for IMIS will be completed. Future efforts will develop, demonstrate, and evaluate the IMIS' ability to work with and augment the built in test capability of future aircraft, including emphasis on engines and mechanical systems. The resulting IMIS will connect to and augment the aircraft's computer to produce data the maintenance technician will use to diagnose, maintain, and manage the aircraft. The end result will enable an integrated approach to total weapon system management and maintenance. It will optimize the roles of technology and the human technician to perform maintenance more efficiently and quickly. The payoff will be increased readiness and sustainabilty of weapon systems.

E. (U) Project: 3203, Integrated Maintenance Information System for PAVE SPRINTER. This is an FY 1986 new start and is a companion program to Project 2950. Whereas Project 2950, IMIS, is developing a general maintenance system for both existing and future aircraft, and covering all aircraft subsystems, IMIS for PAVE SPRINTER is a specific demonstration for avionics systems on the F-16 and Advanced Tactical Fighter. The IMIS for PAVE SPRINTER will demonstrate the integration of interactive, highly portable, maintenance displays and diagnostics utilizing very high speed integrated circuit (VHSIC) computers and self test chips built into the aircraft. It will permit the maintenance technician to readily access the state of gracefully degrading, reprogrammable, redundant circuitry and determine whether a partially degraded system can continue to fly effective combat missions without downtime for repair. It will also instantly display repair instructions when necessary, and allow the technician to query and use the on-board computers and data bus for diagnostics. The result will be drastic reduction in downtime for avionics maintenance, more effective utilization

of maintenance personnel, and higher sortie generation. The IMIS PAVE SPRINTER demonstration on an F-16 testbed will show whether the IMIS maintenance concept is feasible for low risk incorporation into the Full Scale Development of the Advanced Tactical Fighter.

F. (U) Project: 3204, Reliability and Maintainability Design Analysis. This program is an FY 1986 new start. Reliability and maintainability design analysis will be conducted on a continuing basis to identify the generic problems and areas of high potential payoff for logistics reliability and maintainability R&D. Data collection and analysis techniques will be developed and demonstrated as necessary. During FY 1986, three specific efforts will be initiated: (1) analysis of field experience to isolate the specific causes of decision errors that result in costly unnecessary returns of electronic line replaceable units; (2) design analyses to assess potential reliability of the VHSIC 1750A computer and signal processor and impact on weapon system support; and (3) advanced development of methods to assess dormant reliability.

G. (U) Project: 3205, Logistics Expert System. This project will demonstrate the application of decision aiding, including state-of-the-art expert systems, for the management of wholesale logistics. The initial concentration will be on improvements in inventory management and spare parts reprocurement. During FY 1986, an information and decision analysis will be initiated to identify the real data requirements and decision model architecture. The ultimate objective is an automated inventory management process with built-in quality checks, access to accurate, up-to-date information on costs and requirements, and automatic trend analysis. The system will also include impact models that provide warning when changing reliability experience or prices call basic support and provisioning concepts into question. Specific products which are to be available at the completion of this program are: (1) an intelligent work station optimized for use by the Item Manager and System Program Manager at the depot and for use by base level personnel at Air Force bases worldwide; (2) an expert system using the principles of artificial intelligence which will provide base and depot level managers with highorder tools to use in providing maximum logistics efficiency and maximum logistics readiness; (3) an expert system which will be usable by novice managers and base level managers and incorporate the combined wisdom of the best of the Air Forces experienced managers to enable the novice manager to perform at the expert level with minimum training; (4) interconnections and search logic (contained inn the intelligent communications gateways and processors) between the intelligent work station and the logistics data bases at both base and depot level which will automatically route information queries developed as a result of the expert system operation; and (5) communications security monitors which will reside in a dedicated micro computer and be able to detect unauthorized intrusion to systems and system files by authorized users and unauthorized users of the Air Force computer systems. The benefit will be more productivity due to automated aids that speed routine actions and more timely, cost-effective management by exception focused on the real problems that drive support costs.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63107F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Automation of Technical Information (ATI)
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	5,382	4,993	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is an FY 86 new start. This program is the AF part of a joint Service effort to integrate industry and Government logistic data systems and data bases. Provides demonstrations of the integration of capabilities to accept drawings and data in digital form and effectively use these to produce and disseminate technical information needed for procurement, maintenance, and logistics management.

- The objectives of the Automation of Technical Information (ATI) program are efficient and effective receipt, storage, maintenance, and retrieval of technical information; integration of technical information systems with training and skill testing programs; feedback of technical information to weapon system programs for enhancing logistics support analysis capabilities; and integration of technical information systems with maintenance diagnostics, logistics analysis, maintenance management, inventory management, and logistics command, control and communications systems. The ATI program will be a primary means to meet the requirements of Section 1252 of the Defense Procurement Reform Act of 1984. The ATI Technical Integration Office will be the Air Force focal point for assuring technical compatibility of ATI related efforts with the other Services and Industry.

- The near term objective is orderly, logical development of individual ATI projects and programs to permit an early demonstration of technical feasibility to determine the degree of standardization and integration to be expected among the various efforts. Today, engineering data and technical orders are developed, stored and transmitted in digital form by many contractors. A primary task of the ATI Technology Integration Office will be the development of specifications and standards whereby the digital data can be used directly by the Air Force in its Engineering Data Computer Assisted Retrieval System (EDCARS) and the Automated Technical Order System (ATOS). Completion of EDCARS and ATOS programs will allow the Air Force to integrate their output with other technical information programs.

- The long range ATI objective is a modern, flexible technical information system, integrated with other automated systems. The automated technical information system must be adaptable to changing requirements (e.g., added systems or interface requirements, data format changes), have growth potential and continue to support the technical information needs of operational units in the Air Force.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable:

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Under the Structures and Dynamics Project (PE62201F/2401), the Air Force Flight Dynamics Laboratory provided the feasibility demonstration leading to the architecture and software development for the Logistics Systems Technology/Computer Technology for Systems Design and Maintenance, Integrated Design Support (IDS) System (PE 63106F/2940). Analysis methodology and software for graphics transportability are being provided to the IDS system from the Integrated Computer Aided Manufacturing project under PE 78011F, Industrial Preparedness. The US Navy Integrated Diagnostics Support System (PE 63721N) is developing artificial intelligence technology, and the US Army Education and Training Systems/Personal Electronic Aid for Maintenance (PE 64722A/2790), is developing a technical data authoring system that will be used in the Air Force Logistics Systems Technology Integrated Maintenance Information System (IMIS) (PE 63106F/2950). Training Systems Technology, Computer-Based Maintenance Aids for Technicians (PE 63751F/2362) provides the specification for optimal presentation of technical data on an electronic display which will be used in the IMIS project. The Automated Technical Information (ATI) Technical Integration Office will work with the Army and Navy to coordinate Tri-Service activity. Coordination of the three Services activity is achieved through the Joint Logistics Commanders ATI subpanel of the Joint Policy Coordinating Group for Logistics Research, Development, Test and Evaluation, the cooperative involvement in the National Security Industrial Association (NSIA) sponsored Automated Technical Information workshops and the NSIA subpanel on Integrated Diagnostics and the Manufacturing Logistics Computer Aided Design Study Group. This program will ensure that interface standards and specifications are provided for the following programs: Integrated Maintenance Information System (IMIS), Generic Integrated Maintenance Diagnostics (GIMADS), and Logistics Information Management Support System (LIMSS).

6. (U) WORK PERFORMED BY: A Request for Proposal has not been released on this new program. This program element is managed by the Air Force Human Resources Laboratory, Brooks AFB TX, through the Logistics and Human Factors Division, Wright-Patterson AFB OH. The development tasks require multi-laboratory, multi-command, multi-function efforts with specific activity involvement varying from one to several years.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 63107F, Automation of Technical Information.

A. (U) Project Description: The Automation of Technical Information (ATI) program will establish an office to plan, integrate and coordinate projects for the ATI. For the ATI programs technical information includes Computer Aided Design, Computer Aided Manufacture, and Computer Aided Engineering data; engineering drawings and specifications; and technical orders. There are at least ten extant, technologically related, ATI projects within other program elements in the Air Force. Each project has an approved program or project directive. Several are research and development projects cohesively managed by the Air Force Human Resources Laboratory (AFHRL) under PE 63106, Logistics Systems Technology, but others have their own management organization, separate funding, and defined

end product. Each ATI project, by itself, will provide the AF with a new or improved capability. This program element will establish a technical integration office to coordinate the activities of all ATI projects to develop common specifications and standards, conduct integrated demonstrations and testing to assure compatibility. This will prevent duplication of effort and assure that present and future ATI projects progress toward and contribute to a single goal: a totally integrated capability to create, accept, store, maintain, retrieve, distribute, and use wholly digital technical information for the life cycle support of all AF weapon systems. The programs and projects to be integrated are:

- (U) Automated Technical Order System (ATOS) - An Air Force Logistics Command (AFLC) program that is designed to accept and store the technical order information from the contractor in a digital form. This program will provide the Air Force with the capability to rapidly update and print technical orders.

- (U) Engineering Data Computer Assisted Retrieval System (EDCARS) - An AFLC program that will provide the Air Force with the capability to accept, store and retrieve engineering drawings in digital form.

- (U) Logistics Systems Technology/Computer Technology for Systems Design and Maintenance, Integrated Design Support (IDS) System, PE 63106F/2940 - A joint AFHRL and Air Force Flight Dynamics Laboratory research effort. IDS will provide the capability to capture the full weapon system database, including the three dimensional computer aided design/manufacturing images which the contractor uses to design weapon systems and enable electronic access and transfer to the Air Force.

- (U) Functionally Integrated Designating and Referencing System (FINDER) - An AFLC program to provide consistent coding for parts, assemblies, section, etc., to allow cross referencing of work unit codes, technical orders, and drawings. The technical development is conducted by AFHRL as part of IDS.

- (U) Industrial Preparedness/Integrated Computer Aided Manufacturing (ICAM), PE 78011F - A completed Air Force Material Laboratory project to develop a computer based manufacturing system to do sheet metal work for aircraft. The results are being used in Logistics Systems Technology/Computer Technology for Systems Design and Maintenance, Integrated Design Support System, PE 63106F/2940.

- (U) Logistics Systems Technology/Unified Data Base for Acquisition Logistics, PE 63106F/2744 - An Air Force Human Resources Laboratory (AFHRL) program to automate logistics support analysis, integrate logistics planning data with computer aided design, and feedback field experience to assure consideration of logistics lessons learned.

- (U) Training Systems Technology, Computer-Based Maintenance Aids for Technicians, PE 63751F/2362 - An AFHRL project that is developing specifications for delivery of technical orders for electronic display.

Program Element: #63107F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Automation of Technical Information (ATI)
Budget Activity: #2 - Advanced Technology Development

- (U) Integrated Maintenance Information System (IMIS), PE 63106F/2950 - A program under AFHRL to develop the capability for a maintenance technician to perform interactive diagnostics on a weapon system, and to integrate diagnostics, built-in-test functions, and technical orders so that technicians can more effectively perform on-equipment maintenance.

- (U) Other Operational Equipment/Generic Integrated Maintenance Diagnostic System (GIMADS), PE 64708F/3080 - An Air Force Systems Command, Aeronautical Systems Division program to provide design guides and standards for the systematic integrated implementation of IMIS and related diagnostics technology developments on new weapon systems.

- (U) Computer Resources Management Technology/Logistics Information Management Support System (LIMSS), PE 64740F/2983 - This is an Air Force Systems Command, Electronic Systems Division program which will define the logistics data communication architecture. The goal is to network information to multiple users through adoption of state-of-the-art technology.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable.

(2) (U) FY 1985 Program: Not Applicable

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The primary FY 1986 effort will be to develop and validate criteria for interim standards for graphics, text, and data exchange for Department of Defense use. The FY 1986 initiative will lead to a demonstration of an integrated systems approach to automated drawing storage and retrieval and automated generation, storage, and dissemination of technical documentation. This will include integration of the Automated Technical Order System (ATOS) with the Engineering Data Computer Assisted Retrieval System (EDCARS).

(4) (U) Program to Completion: This will be a continuing program. As new techniques and technologies evolve in the area of technical information and documentation and are incorporated into our weapon and support systems, new interface standards and specifications will be required. This program will be the basis and genesis for such standards and specifications. This will include development of a vector capability for EDCARS.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Establish Automation of Technical Information Technical Integration Office	February 1985

(2)	(U)	Demonstrate capability to accept, store, and retrieve engineering drawings in digital form	September 1986
(3)	(U)	Demonstrate capability to accept, store, and retrieve technical order data in digital form	September 1986
(4)	(U)	Interface the drawing and technical order systems.	June 1987

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63202F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Aircraft Propulsion Subsystem Integration (APSI)
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		24,725	26,819	27,493	35,489	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the design, development, and test of new techniques aimed at successful propulsion/airframe integration and compatibility, and improved installed performance in advanced aircraft. The scope of the program includes work on: (1) advanced inlet, fan, power turbine, engine control and nozzle components; (2) integrated testing of these components with advanced gas generators (i.e., Joint Technology Demonstrator engine); (3) methods to reduce engine life cycle cost; (4) definition of engine inlet/exhaust system installation design criteria and propulsion integration technologies; and (5) engine structural design criteria through hardware fabrication and test; and (6) improved engine signature characteristics. These efforts enable early low-risk transition of advanced technology to engineering development and a needed basis for further advances in relevant component technology and integration techniques. Proper attention to the efforts under this program will provide aircraft systems with a potential for longer range, higher cruise speed with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost and improved survivability resulting in increased mission effectiveness.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	25,325	26,967	29,623		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The exploratory development base for this program is provided by Aerospace Propulsion, Program Element 62203F, Materials Program Element 62102F, and Aerospace Flight Dynamics Program Element 62201F. Close technical coordination is maintained with the Flight Dynamics Laboratory, Aerospace Structures/and Materials Program, Program Element 63211F, and with the Materials Laboratory. This program is closely related to the Advanced Turbine Engine Gas Generator program, Program Element 63216F, which is managed from the same office and provides the core gas generator development efforts. This program is thoroughly integrated with the Navy component work under Program Element 63210N Advanced Aircraft Propulsion Systems, which is developing compatible components for a cooperative

Air Force/Navy demonstration of advanced engine technology. The Air Force and the Navy currently have a formal Memorandum of Understanding covering efforts under the Joint Technology Demonstrator Engine (JTDE) program. Close coordination is maintained with related efforts conducted by the Army and National Aeronautics and Space Administration (NASA).

6. (U) WORK PERFORMED BY: This program is managed by the Aero Propulsion Laboratory of the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. The current contractors involved in this program are: Boeing Military Airplane Co., Seattle, WA, (Integrated Propulsion Systems Concepts); Allison Gas Turbine, Division of General Motors, Indianapolis, IN, (Joint Technology Demonstrator Engine Technology); Garrett Turbine Engine Company, Phoenix, AZ, (Joint Technology Demonstrator Engine); General Electric, Evendale, OH, (Joint Technology Demonstrator Engine, Variable Cycle Engine, Structural Methodology); McDonnell Douglas, St Louis, MO, (Inlet/Aircraft Drag Investigation); Pratt & Whitney Aircraft, West Palm Beach, FL, (Structural Design Criteria, Joint Technology Demonstration Engine); and Teledyne/CAE, Toledo, OH, (Low Cost Component Development, Joint Technology Demonstrator Engine, Structural Methodology)

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63202F, Aircraft Propulsion Subsystems Integration (APSI)

A. (U) Project Description: This program provides for the development and functional demonstrations for those advanced technologies which are necessary to assure propulsion and airframe compatibility, and permit the attainment of advanced performance objectives in future aircraft systems. The scope of this program includes: (1) the development of advanced components related to inlets, fans, power turbine, augmentors, controls and exhaust nozzles; (2) the overall integration of these components with the basic advanced gas generators to form a demonstrator engine to define the flowpath and assess the durability/life aspects of the engine concepts; (3) the development of methods to reduce engine life cycle costs by 20-25 percent; (4) the definition and verification of the methodology to structurally design, analyze, and test turbine engines to achieve increased engine durability; and (5) the definition of improved inlet/engine/exhaust system installation design criteria and propulsion integration techniques; and (6) the development of improved engine signature characteristics. The components being developed will provide the basis for 10-20 percent reduction in specific fuel consumption, 10-15 percent increased in stall margins, 15-20 percent reduction in engine weight, increased life/durability, 15-30 percent reduction in engine life cycle cost and greater airflow matching potential when compared to the most modern engines currently in the inventory. These benefits can be traded off against one another to meet the specific needs of systems of interest. This program provides both the critical technology baseline for future system development and a source of data for ensuring the orderly resolution of any propulsion system problems encountered with development engines.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The Joint Technology Demonstrator Engine (JTDE) at General Electric (GE) completed its third build test with major technology advances. The initial assessment of these technologies will provide the basis for the Advanced Tactical Fighter (ATF) propulsion system. The GE JTDE has accumulated over 370 hours of sea level and altitude testing with over 1160 throttle transients. Major technology features of this design, directly applicable to the ATF/Joint Advanced Fighter Engine (JAFE) propulsion system, are (1) variable cycle/variable bypass, (2) fan/compressor integral bladed disc (blisk), (3) counter-rotating spools, (4) full authority digital electro controls, and (5) advanced materials/fabrication techniques. Also during this time period, work continued on the following efforts:

(a) In the JTDE Accelerated Durability Assessment Configuration Experimental Accelerated Mission Testing program, engine tests were completed using life assessment testing philosophy. This provided extensive durability assessment through severe testing in a complete engine demonstrator. This program also permitted earlier extensive durability assessment of selected key JTDE component technologies.

(b) Four follow-on JTDE contracts were initiated with General Electric Co., Pratt & Whitney Aircraft, Garrett Turbine Engine Co., and Teledyne/CAE. These efforts are for hardware fabrication and performance/durability testing of advanced concepts applicable to advanced tactical fighter and strategic weapon systems; JTDE testing incorporating extended performance verification and structural/diagnostic test and evaluation will be continued. A piggyback engine test will provide final verification of a life cycle cost model previously developed. Critical variable cycle engine technology demonstrations will focus on verification of operating characteristics through slave engine and rig tests at sea level and altitude conditions.

(c) An advanced augmentor effort was initiated based on exploratory development efforts currently being conducted.

(d) In the Life Cycle Cost/Damage Tolerance Assessment program, component selection, design and fabrication using damage tolerant design criteria were completed on selected components for subsequent piggyback JTDE testing. This program developed a damage tolerant design system and provided a life cycle cost evaluation applicable to hot-section components.

(e) In the Advanced Exhaust System Materials Demonstration program, an advanced exhaust system, with advanced materials, was fabricated and tested in a jointly sponsored Air Force/National Aeronautics and Space Administration engine test. A follow-on Advanced Exhaust Nozzle Technology new start effort integrates advanced materials, thrust vectoring/reversing capabilities, and improved signatures in exhaust nozzle designs for subsequent engine test.

(f) In addition, efforts will be continued in the engine/airframe integration area, specifically in the advanced exhaust nozzle material applications area, and the integrated propulsion system concepts area.

(g) Integrated Propulsion System Controls contracts were initiated with three contractors to accomplish design trade-offs for integrated electronic control systems with expanded aircraft flight control requirements. These efforts are the basis for the Integrated Reliable Electronic Control Reliability and Maintainability initiative which is planned to start in FY 1985. This work is in support of a DOD new initiative on Engine Electronic Controls Reliability and Maintainability. Preliminary design and fabrication of a reliable, fault-tolerant engine control will be initiated based on an earlier design/trade study.

(h) The Engine Durability Assessment program was initiated to provide the technology to meet the adverse structural conditions imposed on the fan component. Emphasis in this program is on the structural demands to the engine caused by improved signature designs of the air induction system. In addition, an effort was initiated to design and test engine front face configurations which will provide improved signature characteristics.

(2) (U) FY 1985 Program: Technical efforts during this time period will bring to fruition many of the previous year's programs. In the Joint Technology Demonstrator Engine Program (JTDE), level II structural/diagnostic testing, extended performance characterization testing and life assessment testing will be accomplished. Testing of an advanced material metal matrix composite fan will be performed on a JTDE. Fabrication and initial subsystem testing of an advanced engine electronic control will be initiated. Follow-up effort will be initiated on the Advanced Propulsion Integration Concept program. In addition, a new effort will be initiated in the small engine (cruise missile) technology area. This effort will be applicable to advanced tactical and strategic systems. The test and assessment of the technologies during this time period will lower the technical risk and provide the basis for transition of critical technologies to the Advanced Tactical Fighter propulsion systems for both tactical and strategic aircraft.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Technical effort during this time period will include comprehensive JTDE testing of new generation engines. Emphasis will be on durability testing of the Experimental Accelerated Mission Testing type and initial operability testing at simulated altitude conditions. The turbine engine technologies demonstrated with these tests will lower the technical risk and provide the basis for transition of critical technologies particularly applicable to advanced tactical systems. Included is comprehensive flight envelope testing at the new Aeropropulsion Systems Test Facility propulsion wind tunnel at Arnold Engineering Development Center. The Expendable Turbine Engine Concept demonstrator (cruise missile) program will continue with design and fabrication of advanced strategic and tactical missile propulsion configurations for subsequent testing. The Reliability and Maintainability (R&M) initiative in engine electronic controls will include initial subsystem and

engine testing. Also, advanced materials applications and reduced Operating and Support cost efforts will continue. Implementation of the High Mach Propulsion New Initiative will be demonstrated, and will provide an assessment of turbopropulsion systems with significantly increased high mach capability to Mach 6. The cost estimates for this program are based on contractual commitments which extend through FY 1987, plus historically based cost estimate for a level of effort testing which is included in the APSI Five-Year Plan as directed by the APSI Program Management Directive. The cost estimate is category IV.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element #63203F Title: Advanced Avionics For Aircraft
DOD Mission Area: #551 - Electronic and Physical Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	21,800	20,000	22,651	31,205	Continuing	N/A
69CK	Advanced Devices	8,906	6,903	3,890	6,200	Continuing	N/A
69DF	Advanced Weapon Delivery	7,047	1,023	4,750	9,050	Continuing	N/A
666A	Advanced Reference Systems Development	2,240	1,945	4,650	5,450	Continuing	N/A
2733	Advanced Reconnaissance/ Strike Radars	3,607	10,129	9,361	10,505	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The threat posed by the Warsaw Pact is steadily increasing in both quantity and quality. To successfully contend with the threat postulated for the early to mid nineties, our forces require significant capability improvements in aircraft avionics. This program element is the principal Air Force source of advanced avionics technology to accomplish the navigation, target acquisition, weapon delivery and fire control functions. The primary effort in FY 1986 will be the continued development of the Ultra-Reliable Radar (URR), a demonstration of advanced radar technology planned for incorporation in the Advanced Tactical Fighter.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY:

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	19,900	21,822	24,106		Continuing	N/A

In FY 1984, $1,900 was reprogrammed into this program element to accomplish the multimode radar effort. In FY 1985 the Congress reduced requested funding by $1,822.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable

5. (U) RELATED ACTIVITIES: The exploratory development for this program is PE 62204F, Aerospace Avionics. Efforts transitioned include work on solid state active aperture arrays for high reliability airborne radars, a family of standard high speed analog-to-digital converters for avionics subsystems and an advanced multiple target attack fire control system using synthetic aperture radar weapon cuing.

6. (U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratory/Avionics Laboratory, Wright-Patterson AFB, OH, under the overall management of the Air Force Systems Command, manages the projects in the Advanced Avionics for Aircraft program. Contractors include: General Electric, West Lynn, MA and Binghamton, NY (Proj 69DF, 69CK); Westinghouse Electric Corp, Baltimore, MD (Proj 2733); Harris Corp, Melbourne, FL (Proj 666A); TRW Corp, Lawndale, CA (Proj 666A, 69CK) and Texas Instruments, Dallas, TX (Proj 69CK). An additional 11 contractors/universities are under contract for $9.5 million of Research and Development efforts.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 666A, Advanced Reference System Development: This project is developing very accurate reference sensors (inertial navigation systems) for cruise missiles, strategic aircraft and tactical fighters to improve weapon delivery and navigation capabilities. In FY 1983 work on the Integrated Inertial Reference Assembly preliminary design was completed. This effort seeks to reduce by two thirds the number of inertial sensors required on fighters, increase mean-time-between-failure (MTBF) to 2000 hours, and decrease maintenance costs. Final design and fabrication begins in FY 1986. The joint Air Force/Navy development of a high accuracy ring laser gyro to increase cruise missile strike capabilities and provide motion compensation for advanced sensors will continue. The Adaptive Multifunction Antenna effort will be completed in FY 1985. This provides the technology to reduce the number of antennas needed on fighters by sharing high anti-jam antenna receiving elements for multiple signal processing.

B. (U) Project: 69CK, Advanced Devices: This project supports studies of key electronic devices to hasten transition from feasibility to systems application. Specific areas are chosen where improvements in performance, cost and reliability will improve the quality, capability and/or life cycle costs of Air Force systems. In FY 1984 work continued on the development of a high power gallium arsenide (GaAs) combiner. This solid state amplifier offers significant advantages in weight, volume, reliability and power requirements for missile radar sensors. Work continues in FY 1985 on the solid state phased array aperture for the Ultra-Reliable Radar. Development of a flight qualifiable high power agile laser source for reconnaissance/strike and electronic warfare application will be continued as will a carbon dioxide laser radar source for use in laser radars and weapon system delivery applications. The advanced devices portion of the magnetic bubble, high density memory system for airborne and spaceborne systems will be completed in FY 1985. In FY 1986 efforts will be initiated to develop: 1) wide band, multiple function, active Radio Frequency (RF) modules which support radar and electronic counter-countermeasure (ECCM) functions from a single aperture; 2) military specification qualified, magnetic bubble memories which will provide a non-volitile mass memory capability for aerospace vehicles; and 3) a high temperature detector for CO_2 laser radiation capable of operating at 195°K, thus enabling use of a thermal electric cooler to improve sensor system reliability.

C. (U) Project: 69DF, Advanced Weapon Delivery: This project improves the mission effectiveness of combat aircraft by extending the operational capability of both air-to-air and air-to-ground weapon delivery systems. It develops sensors, components, subsystems and techniques to improve weapon delivery while enhancing survivability. The

work includes new algorithms and integration techniques to reduce pilot workload while significantly enhancing man/machine information transfer. Previously successful development of an advanced air-to-air missile launch envelope (MLE) algorithm has been expanded to allow incorporation in the Advanced Medium Range Air-to-Air Missile (AMRAAM). Pilot evaluations of the algorithm were accomplished in the McDonnell-Douglas facility in August 1983 with a similar effort at General Dynamics in December 1983. The Infrared Search and Track System (IRSTS), combined with existing intercept radars, will provide the Air Force with a greatly improved intercept capability against high speed, low radar cross section threats. In FY 1984 both IRSTS Manufacturers, General Electric and ITT Avionics, entered the integration and assembly phase of the program. Deliveries of prototype systems to Eglin AFB, FL will occur in early FY 1985 for test and evaluation. In FY 1986 a design effort will begin on the IRST prototype systems to permit incorporation of a Very High Speed Integrated Circuit (VHSIC) advanced modular architecture in the mid-1990's. Exploratory development will lead in late FY 1985 to the initiation of the Air-to-Air Battle Management simulation. This effort will develop the mission software comprised of target identification algorithms for PE 63742F, Combat Identification Technology, missile launch computations and attack management and steering cues for use in a multiple target environment. Under the multiple target attack (MULTACK) program, a core fire control system will be defined for advanced air-to-ground weapons to enable multiple kills per pass. This effort will integrate both in-weather and under-weather advanced sensors. In FY 1986, software development will lead to pilot-in-the-loop evaluations in FY 1988. Fire control software will be provided to the Air Force Armament Division, Eglin AFB, FL, to integrate the aircraft avionics with various short range self-protection weapon options and demonstrate enhanced capabilities.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2733, Advanced Reconnaissance/Strike Radars

A. (U) Project Description: This project develops and demonstrates new radar system capabilities addressing Air Force requirements. The major radar technology objectives of this project address: 1) an in-weather capability for detection, acquisition, location and strike of fixed, stationary and moving tactical size targets; 2) a multiple target detection, track and missile launch capability; and 3) improved reliability, availability and maintainability at reduced acquisition and life cycle costs. These developments also include requirements for reduced emissions and electronic counter-counter measures (ECCM) techniques needed for survival in the 1990's threat environment. This project was initiated in FY 1982 to work on low probability of intercept - terrain following (LPI-TF) techniques and slow ground moving target indication/location (SGMTI/L) analysis and simulation. The LPI-TF effort offers enhanced survivability by substantially reducing RF radiation coming from penetrating aircraft. In FY 1985, a major effort to develop the technology for the next generation radar is being initiated. The objective of the Ultra-Reliable Radar (URR) program is to improve airborne radar mean-time-between failure by an order of magnitude over that of current radars. The URR effort will take advantage of the latest hardware technology developments (i.e., active array and Very

High Speed Integrated Circuits (VHSIC)) and integrate them into a fault tolerant architecture defined by the Advanced System Avionics Program, PE 63253F, Project 2734, which allows optimal on-equipment maintenance (flight line and depot). The URR will possess multimode capabilities, allowing it to support both air-to-air and air-to-ground missions.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Completed low probability of intercept (LPI) demonstration of covert radar techniques for terrain following (TF) and motion compensation analysis for F-15 radar.

(2) (U) FY 1985 Program: Initiate Ultra-Reliable Radar (URR) Development. This program will capitalize on the Solid State Phased Array developed under project 69CK, Very High Speed Integrated Circuits (VHSIC) technology and the Common Signal Processor program. The URR development will result in a multi-mode radar capable of air-to-air and air-to-ground detection of multiple targets with an order of magnitude increase in radar system availability.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continue development of the URR through detailed system design. Support development of the 1750A VHSIC computer and the Common Signal Processor (CSP) which capitalizes on VHSIC and is capable of processing radar and EW signals.

(4) (U) Program to Completion: Continue development of URR through rooftop and flight testing. Continue supporting development of a Common Signal Processor and a 1750 VHSIC computer.

C. (U) Major Milestones:

	Milestones	Date
(1)	Complete radar human factors simulations	September 1983
(2)	Complete initial investigation of LPI TF	March 1984
(3)	Initiate URR Development	January 1985
(4)	Complete URR Ground Demonstration	March 1989
(5)	Complete URR Flight Demonstration	September 1990

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63205F — Title: Flight Vehicle Technology
DOD Mission Area: #553 - Engineering Technology (ATD) — Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		13,000	15,617	22,884	27,419	Continuing	N/A
2506	Control of Flight	7,700	7,117	15,350	18,411	Continuing	N/A
2507	Vehicle Equipment	2,800	2,000	2,348	1,567	Continuing	N/A
2508	Aeromechanics	0	0	490	3,525	Continuing	N/A
2978	Reliability and Maintainability for Flight Vehicle Technology	2,500	3,500	3,718	3,916	Continuing	N/A
3197	AFTI/F-16 Support		3,000	978		0	3,978

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports development of new highly reliable and maintainable aeronautical technologies for transition to current and future Air Force weapon systems. Technologies investigated include enhanced flight control and weapons delivery systems for Air Force fighters, systems for reduced maintenance cost, increased aircraft survivability/reliability, and systems for increased aircraft fuel efficiency/range. Part of this program develops the aeronautical technologies to be integrated and demonstrated in PE 63245F, 2682, Short Takeoff and Landing (STOL) and Maneuvering Technology Demonstration (MTD). The ATF statement of need and the Scientific Advisory Board both have vlaidated this requirement for reduced takeoff and landing distances. Project 3197 does hardware and software development of the Automated Maneuvering Attack System for the Advanced Fighter Technology Integrated/F-16 testbed aircraft. Project 2508 will develop adaptive flutter suppression to enhance survivability of tactical fighters. In project 2507, Atmospheric Electricity Hazards Protection system criteria development will conduct ground test evaluation of these criteria on advanced testbed aircraft. Project 2506 initiates design of integrated flight/propulsion control system and advanced pilot vehicle interface program for the next generation fighter related STOL/MTD program. Project 2978 is a separate project focusing its attention on improving reliability and maintainability of products being developed within this program element.

Program Element: #63205F
DOD Mission Area: #523 - Engineering Technology (ED)

Title: Flight Vehicle Technology
Budget Activity: #2 - Advanced Technology Development

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	13,000	20,917	21,887	N/A	Continuing	N/A

EXPLANATION: (U) FY 1985 funds were reduced by Congress. An additional $4 million will be added to cover a concurrent overrun on the AFTI/F-16 contract.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program is developing the Automated Maneuvering Attack System (AMAS) and the Short Takeoff and Landing/Maneuver Technology Demonstrator (STOL/MTD) control system for demonstration in PE 63245F, Advanced Fighter Technology Integration (AFTI). The AFTI program, in turn, provides technology options in the design of the next generation fighter. The Digital Flight Control system was developed under this PE, flight validated on the AFTI F-16 test vehicle under PE 63245F during FY 1983 and is jointly funded by Army and Navy. The Atmospheric Electricity Hazards Protection (AEHP) program is a joint development with the Army, Navy, National Aeronautics and Space Administration, Defense Nuclear Agency, and the Federal Aviation Administration. It will be carried out in consonance with an approved Interagency Management Plan, and is being fed by the 6.2 AEHP efforts in these same agencies. The Reliability and Maintainability program will develop and demonstrate, in conjunction with PE 63245F, Advanced Fighter Technology Integration (AFTI), project 2979, technology to improve the reliability and maintainability (R&M) of modern and advance flight control systems.

6. (U) WORK PERFORMED BY: This program is managed by the Flight Dynamics Laboratory, Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. Flight testing of the F-16 testbed vehicle will be accomplished at the Air Force Flight Test Center, Edwards AFB, CA, under an approved Statement of Capability. The contractor is General Dynamics Corporation, Ft. Worth, TX. The AEHP Program is under contract to the Boeing Aircraft Company, Seattle, WA. The contractor for the STOL Maneuvering Technology Program is McDonald Douglas Company, St Louis, MO. The R&M project is currently contracted to all seven main airframers in equal shares totalling $3.5 million in FY 1985.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2507, Vehicle Equipment. Science and Technology effort to develop aeronautical components that will reduce life cycle costs, space, weight, and power requirements of various subsystems associated with military aircraft. Atmospheric Electricity Hazards Protection (AEHP) program is funded under this project. The AEHP program will address the lightning and electromagnetic interference hazards to new generations of aircraft caused by widespread use of

sensitive micro-electronic systems and advanced composite materials. The Atmospheric Electricity Hazards Protection (AEHP) program will be conducted in three phases: Phase I will establish preliminary hardening design criteria, methodology, and design of testbed aircraft; Phase II will demonstrate optimized hardening measures of electrical/electronic subsystems on the testbed aircraft; Phase III will develop design criteria for hardening fuel tanks and low observable structures against electrical threats. The FY 1984 Accomplishments include: (1) design criteria established in Phase I was used to optimize and test AEHP protection in representative testbed aircraft (a/c); (2) testing of design criteria developed in Phase I continued throughout FY 1984. An all composite F-16 forward fuselage was used in testing. In the FY 1985 Program the testing of design criteria will provide input for development of a design guide. The FY 1986 Planned Program is (1) the helicopter AEHP demonstration of full threat, 200kA, with YUH-61 testbed employing digital very large scale integrated avionic/flight control suites; (2) establish qualification test procedures for full a/c, subsystem and line replaceable units (LRU) level AEHP evaluation; (3) conduct first update of Interim Design Criteria and Guides; (4) develop AEHP for fuel tank/system hardening; (5) finalize radar absorbing material/radar absorbing structures (RAM/RAS) AEHP and initiate an effectiveness demonstration; (6) define and initiate demonstration program for AEHP of composite a/c. This continuing program will develop (1) AEHP for a/c electrical/electronic systems protection will be demonstrated and documented for fighters, bombers/transports, helicopters, cruise missiles. (2) Perform direct effect protection demonstrations for fuel tanks/systems, RAM/RAS, new structural materials. (3) Demonstrate AEHP effectiveness qualification and surveillance procedures for fighters, bombers/transports, helicopters, and cruise missiles.

B. (U) Project: 2508, Aeromechanics. Demonstrates the feasibility and performance advantages of advanced aeronautical devices and configurations. The candidate task in this project is active flutter suppression in FY 1986. Active flutter control will use sensors interacting with the flight control system to eliminate aero-structural divergence with external stores. This will expand the flight envelope and enhance survivability. Develops and flight validates adaptive flutter suppression for increasing low altitude penetration speed by 25%, eases store clearance requirements, and provides this flexibility to field commander for weapons load-out selection. This allows aircraft to be loaded for and attack more than one target per sortie, thereby reducing the number of sorties required per target and increasing survival rates. In FY 84-85, the program contains only planning and review of 6.2 development efforts. The FY 1986 Planned Program is scheduled for a late start in FY 1986; During Phase I, Preliminary Design, the initial system design will be performed based on analysis and wind tunnel tests. Stores configuration section will be complete in FY 1986. Engineering Analysis and aircraft modification preliminary design will be initiated. This continuing program, in FY 1987, will complete Phase I, Preliminary design, and Phase II, detail design will be initiated, including system brassboard and detail drawings. A flutter suppression routine will be added to the flight control software. In Phase III, Aircraft Modification, the modification will be made to the test aircraft, and ground tests will be performed to update analyses. Flight demonstration is scheduled for late FY 1988 and will include the carriage of many flutter critical stores and the release of stores to create the most flutter critical wing loadings.

C. (U) Project: 2978, Reliability and Maintainability for Flight Vehicle Technology. This project will design and demonstrate a Self-Repairing Flight Control System (SFCS) that significantly improves the reliability of the total

flight control system for Advanced Tactical Fighter (ATF) by two orders of magnitude over present day fighters. Use of reconfiguration at a higher level of system redundancy will be employed. Dynamic reallocation of resources and functions is used instead of relying on brute force replication of hardware for fault tolerance and reliability. Reconfiguration exploits the multiple control surfaces of modern advanced fighter aircraft to eliminate critical single point failures in actuators and control surfaces. Ideally, since no surface is then critical to safety-of-flight, the control system can be significantly simplified by reducing the redundancy level of elements within the system. Reconfiguration dramatically increases the survivability and safety-of-flight for aircraft subjected to battle damage. Automated maintenance diagnostics techniques utilizing expert system technology will simplify maintenance in the field, reduce the time to diagnose and repair a fault, and to support the two level maintenance concept. Expert systems are capable of reducing the present high false alarm rate, as well as eliminating the removal of non-failed components. The control surface reconfiguration concept will be flight demonstrated on a modern high performance aircraft. A subsequent design iteration will fully exploit the impact of reconfiguration on the design of the next generation fighter. The project will also modify an F-15 with a dual set of highly reliable ring laser gyro navigation systems to provide the capability of performing flight control and navigation from a common set of sensors. An appropriate fault tolerant, multifunction sensor and processing reconfiguration has been developed and will be flight tested under this project to demonstrate flight control safety and performance while maintaining required levels of navigation accuracy. This capability allows a 67 percent reduction in the number of LRUs required for these functions. The attendant gains in system safety and reliability will decrease maintenance time and costs. Output will be design guidelines and criteria to update specifications for inertial reference equipment. The FY 1984 accomplishments include: (1) the successful laboratory demonstration of the self-diagnosis capability on a portable computer. Development of the base line control system which can later incorporate SFCS continued. Feasibility demonstration of Multifunction Flight Control Reference System (MFCRS) was initiated in FY 1984 and will be continued to resolve airframe/avionics interference effects. The FY 1985 Program will: Flight test MFCRS. MFCRS demonstration will be completed by FY 1985. Continue work on SFCS at reduced level. FY 1986 Planned Program: Develop new Flight Control System (FCS) architectures and control elements for a control reconfigurable aircraft and develop the logic and simulation software for the selected reconfiguration strategy. Integrate these elements on Flight Dynamics Lab's simulation/rapid prototyping facility, and evaluate, assess, and refine the preliminary designs. Finalize the technical assessment of a Flight Control Analysis maintenance diagnostic system projecting the size, logistics impact, and utility of a fully developed system and expand the 300 rule lab demonstration model. The addition of funds to this project by PBD 617 will enhance the development of autonomous automated diagnostics and make it available for use on the ATF, potentially reducing flight control maintenance by a factor of seven. This continuing program will conduct simulation conduct simulation tests, evaluations, and assessments of the interactive control reconfigurable aircraft models and high order language (Ada) programmed reconfiguration strategies using breadboard equipment. It will expand the Flight Control system (FCS) maintenance diagnostic system for an existing aircraft, from 300 to 2000 rules, providing full FCS diagnostic capability and extend the diagnostics to the new Self-Repairing Flight Control System (SFCS) architecture for ATF.

D. (U) Project: 3197, Advanced Fighter Technology Integration (AFTI)/F-16 Support. This project is an administrative breakout in FY 1985 of the AFTI/F-16 support from project 2506, Control of flight, to improve management

visability. It develops the indivudual technologies that are flight Validated on the Advance Fighter Technology Integration (AFTI) F-16 in PE 63245F. It provides the support needed to keep these components operational during flight test. These components include (1) helmet mounted sight, (2) wide field of view heads up display, (3) voice command interface, (3) conformally mounted forward looking infrared sensor/tracker with an optically co-axial laser designator, (4) moving map display, and a (5) 360° (roll) radar altimeter among others. In FY 1984, a Digital Flight Control System and pilot vehicle control and display interface have been flight demonstrated in the AFTI/F-16 test vehicle under PE 63245F. The Digital Flight Control System, in conjunction with additional control surfaces on the AFTI/F-16 provides independent six degree-of-freedom control, and task-tailors the flight control laws to the aircraft mission. This capability integrated with the flight/fire control system, a Forward Looking Infrared (FLIR) sensor/tracker, and other technologies will be demonstrated during the Automated Maneuvering Attack System (AMAS) phase of the AFTI/F-16 program. The FY 1986 planned program will conduct the operational evaluation of the Automated Maneuvering Attack System at Nellis Air Force Base. This will be conducted using pilots from the Air Force, Navy, and Marines and is critical to the eventual acceptance of this valuable technology to the operational forces. Later in the year, the aircraft will begin modifications to prepare it for use in the Terrain Following/Terrain Avoidance/Threat Avoidance (TF/TA^2) program. The Pilot Vehicle Interface (PVI) technology definition studies will be completed in the Terrain Following/Terrain Avoidance/Threat Avoidance TF/TA^2 program and acquisition of vendor hardware and software for the head-steered Forward Looking Infrared Sensor Tracker (FLIR) and digital map will be initiated. In the outyears as programs are identified that will use the AFTI/F-16 their funding will be moved into the project.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project, 2506, Control of Flight.

A. (U) Project Description: This project develops technologies needed for fighter aircraft to be viable in the 1990's and beyond. Exploratory development efforts performed during past years have identified a number of promising aeronautical technologies that offer large improvements in capability and survivability over current fighter systems. In order to provide systems developers the assurance needed to build the next generation of fighters using these advanced technologies, the laboratory developments must be validated in flight. Project 2506 develops several of these technologies for flight testing. The Integrated Flight/Propulsion Control (IF/PC) System and Advanced Pilot Vehicle Interface such as automated thrust vector controls and precision landing cuing, will be developed, and then flight tested under PE 63245F as a part of the STOL/MTD program.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Initiated a program in Integrated Flight/Propulsion Control and Pilot Vehicl Interface to provide the necessary controls and displays to accomplish the STOL/MTD capability. This technology will directly support the STOL and Maneuvering Technology Demonstrator project in PE 63245F, Advanced Fighter Technology Integration (AFTI). The AFTI/F-16 FY 1984 accomplishments are now listed in Project 3197.

(2) (U) FY 1985 Program: FY 1985 will see the development of the integration of flight and propulsion control design concept completed along with the requisite pilot/vehicle interface design and analysis. In the third quarter, integration into the testbed aircraft will begin. The Integrated Control Avionics for Air Superiority (ICAAS) program will be started, late in the year, to flight validate the Advanced Air Battle Management algorithms prior to their implementation in PAVE PILLAR.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: This program is critical to the development of a short takeoff and landing capability, that does not degrade up-and-away performance, for the Advanced Tactical Fighter (ATF). The ATF Statement of Need and the Scientific Advisory Board both have validated this requirement for reduced takeoff and landing distances. Flight Control and Pilot Vehicle Interface (PVI) component development will be completed and provide an integrated flight/propulsion control system for STOL/MTD. Control law development will be 67% complete. The (ICAAS) program tactical flight management algorithms, pilot assist features, and cockpit layout will be designed and the interface to the air battle management fire control system will be initiated. The cost of these efforts has been derived from contract bid costs and independent laboratory estimates. Both indicate this to be a mature estimate of the minimum expected cost of this effort.

(4) (U) Program to Completion: This is a continuing program. (1) Integrated Flight/Propulsion Control System be completed and Operational Flight Program (OFP) for integration into the aircraft developed. All cockpit control and displays will be completed and evaluated through man-in-the-loop simulations. (2) ICAAS: OFP which merges the tactical flight management and air battle management algorithms will be completed. The control system interfaced to the Advanced APG-70 radar, the Infrared Search and Track, will be completed and checked-out. Inputs to the flight test program will be made based upon completion of ground testing. (3) Development of the energy management software for integration into the unmanned Strategic Boost Glide Vehicle will be started. Automated flight controls componentry capable of withstanding high (2000°+) temperature, high g flight environment for long periods of time will be developed and tested. Upon completion of these programs, a major portion of the technologies needed to be effective in the post-1995 threat environment will be available to the Air Force. As new efforts are put on contract new projects will be established.

C. (U) Major Milestones:

Milestones	Dates	
(1) (U) SHORT TAKEOFF AND LANDING/MANEUVER TECHNOLOGY DEMONSTRATOR;		
Complete Flight Control Component Development	August	1986
Complete Flight Control Design	April	1987
Certification of Flight Control System	March	1988

Milestones	Dates	
(2) (U) INTEGRATED CONTROL AVIONICS FOR AIR SUPERIORITY:		
Tactical Flight Management Design	April	1986
Complete Man-in-the-Loop Simulation	October	1987
OFP Complete	October	1988
Documentation Complete	January	1990
(3) (U) STRATEGIC BOOST GLIDE:		
Flight Control Design	June	1989
Componentry Tested	November	1990
Certification of Flight Control System	May	1991

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63208F
DOD Mission Area: #551 - Electronics and Physical Sciences (ATD)

Title: Reconnaissance Sensors/Processing Technology
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		4,975	8,323	9,182	10,861	Continuing	N/A
565A	Reconnaissance Sensor/ Processing Technology	4,975	8,323	9,182	10,861	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Science and Technology program has a single project which contains all advanced development activities for new and improved sensors and real-time imagery processing systems. Current emphasis is on development of advanced sensors for extended range and improved adverse weather capability for both strike and reconnaissance missions and enhanced processing capabilities to automate and expedite exploitation of time sensitive reconnaissance information. The program provides for improved capabilities to rapidly detect, locate and classify moving and stationary targets, day or night, in adverse environmental conditions, for both strike and reconnaissance missions. These capabilities are critically needed to provide real-time and near real-time reconnaissance information to tactical commanders under fast moving battle conditions, to improve tactical and strategic strike mission effectiveness and survivability, and to reduce pilot workload.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,975	8,323	10,484		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: Exploratory development efforts are phased into this program from Program Element (PE) 62204F, Aerospace Avionics. The technologies emanating from this program are transitioned into engineering development PEs such as 64710F, Reconnaissance Equipment; 63249F, Night Attack; 64249F, Night Precision Attack Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) Systems; and will provide the sensor/processing technology for the Advanced Tactical Air Reconnaissance System (ATARS). Coordination with the Army and Navy on related advanced development work is accomplished by direct liaison between corresponding levels of program management and through the Joint Deputies for Laboratories Sub-Panel on Night Vision. Joint Air Force/Navy testing is planned to evaluate advanced sensors for both Air Force and Navy missions. PE 63727F, Advanced Communication Technology, is developing the associated Airborne Imagery Transmission (ABIT) data link requried to provide timely reconnaissance information to Tactical

Commanders. Rome Air Development Center, Griffiss AFB, NY, in PE 63789F, Command, Control and Communications Advanced Development, is evaluating and upgrading the ground data handling recording system developed under this PE. Participation in the Automatic Target Recognizer Working Group (ATRWG) continues to develop tri-service and industry standards for Automatic Target Recognizer test and evaluation. Coordination with the B-1B program to transition the second-generation Forward Looking Infrared (FLIR) Advanced Target Acquisition Sensor (ATAS) under the proposed Imprecisely Located/Relocatable Targets program is ongoing. The ATAS FLIR is the baseline sensor in this proposed program.

6. (U) WORK PERFORMED BY: Program management is the responsibility of the Air Force Systems Command through the Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, with participation of the Rome Air Development Center, Griffiss AFB, NY. Major contractors are: Hughes Aircraft Co., El Segundo, CA, for the Advanced Target Acquisition Sensor (ATAS); Rockwell International Corp., Anaheim CA, and Honeywell, Inc., Minneapolis, MN, for FLIR automatic target recognition (Imaging Sensor Autoprocessor); LTV Vought, Co, Dallas, TX; and Honeywell, Inc., Minneapolis, MN for carbon dioxide laser automatic target recognition (Automatic Laser Target Classification). There are two additional contractors with a contract value totaling $1.5 million.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 665A, Reconnaissance Sensor/Processing Technology

A. (U) Project Description: This single project provides the technology base for new and improved reconnaissance sensors and real-time imagery automatic target recognition and processing systems. This technology development will provide a capability to rapidly detect, locate and classify moving and stationary targets day or night in adverse environmental conditions. This capability is critically needed to provide real-time and near real-time reconnaissance information to tactical commanders under fast moving battle conditions as well as to improve strike mission capability and survivability while reducing pilot workload. Specific major development efforts include the following. The Advanced Target Acquisition Sensor Program to demonstrate and flight test validate the second generation FLIR sensor and autoprocessor system. This system provides twice the range and target resolution of current FLIR sensors. The improved FLIR image quality is needed to realize acceptable automatic target detection and classification performance from real-time target recognizers. A major data collection effort managed through this project to acquire high quality infrared imagery data needed for DOD and industry wide test and evaluation of automatic target recognizer systems and algorithms. Both tower and airborne data collection systems, using the high resolution second generation FLIR developed in this program element, will be employed to acquire these data which will be utilized by all three Services and DOD contractors as a standard infrared imagery data base. Automatic target recognizer systems to replace manual search/

interpretation of target information. This task includes development of an advanced autoprocessor system based on technology developed for electro-optical imagery processing and extended to have a dual capability to: 1) automatically detect targets from radar data; 2) and to cue the sensor and then automatically classify those targets as to type using imagery from the infrared (FLIR) sensor. Very High Speed Integrated Circuit (VHSIC) technology is being incorporated into this system. All-weather target detection radar with the capability to automatically detect targets masked by camouflage and foliage. Carbon dioxide laser automatic target recognition systems will provide improved automatic targeting capability as well as multiple target tracking and multiple weapons guidance capability for strike missions. This technology will also provide automatic terrain following and terrain avoidance for low-level penetration missions. A carbon dioxide laser sensor data base will be collected for algorithm development and evaluation.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Preliminary design of VHSIC hardware for an Automatic Target Recognizer system with continuing optimization of target detection classification algorithms. Functional demonstration of a real-time target detection/classification suite. Initiation of the Carbon Dioxide Laser Automatic Target Classifiation program. Continued breadboard fabrication for second generation FLIR system.

(2) (U) FY 1985 Program: VHSIC hardware design and initial fabrication of a real-time Automatic Target Recognizer. Continue data collection effort to acquire high quality infrared imagery data base. Integrate brassboard components on the Advanced Target Acquisition Sensor and perform a system evaluation and full-scale imaging demonstration at the contractor's facility. Develop and test carbon dioxide laser sensor algorithms for target detection/classification, and collect a carbon dioxide laser sensor data base. Initiate development of a special long wavelength radar to detect targets concealed by foliage and camouflage. This radar will cue electro-optical sensors for target identification to provide a major advance in all-weather, long-range reconnaissance capability. Continue the development of the automatic target recognizer system, including the initial demonstration of a real-time autoprocessor using advanced algorithms. Continue the brassboard fabrication of the Advanced Target Acquisition Sensor with a full-scale imaging system demonstration at the contractor's plant. Initiate flight test and data collection of carbon dioxide laser sensor developed under PE 62204F. Data gathered will enhance the laser sensor data base for target recognition training and evaluation.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continue carbon dioxide laser sensor algorithm development and associated processor design. The program will be used to evaluate automatic target classification using a carbon dioxide laser sensor system, and to gather a carbon dioxide laser data base for algorithm testing and validation. Continue carbon dioxide laser sensor flight test and data collection. Flight test

data will be used to enhance the data base for laser sensor target recognizer development and evaluation. The algorithm evaluation/optimization phase of this program is planned to continue through FY 1989; as technology is successfully demonstrated, it will be transitioned to appropriate Full Scale Development programs. This program is closely integrated with the Cruise Missile Advanced Guidance (CMAG) program to exchange findings and prevent duplication of effort. The Advanced Target Acquisition Sensor (ATAS) Program will continue in FY 1986 with aircraft environment testing, in-house evaluation, and both tower and flight tests. Infrared imagery collected from tower and flight tests will be uniformly coded to enhance the infrared imagery data base for Automatic Target Recognizer (ATR) test and evaluation. Close coordination with the ATR community insures that the data collected meets the requirements for ATR test and evaluation. Producibility investigations will continue in response to B-1B System Program Office (SPO) interest in this technology. The technology will be available for transition in FY 1987. Fabrication of one advanced ATR system using VHSIC technology will continue in FY 1986. The program provides for design and fabrication of a system based on technology developed for electro-optical imagery processors with the added potential to process radar data for target detection. Development of advanced algoithms for Automatic Target Detection and classification will also continue under this effort. The VHSIC hardware will be mated with the ATAS for flight test and evaluation in FY 1987. Continue design of special long wave length radar which will have the unique capability to detect military targets concealed by foliage and camouflage.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) Initiate Foliage Penetration Radar	September 1985
(2) Complete and Transition Advanced Target Acquisition System	September 1987
(3) Complete Flight Evaluation of Integrated FLIR/VHSIC Target Recognizer	March 1988
(4) Complete CO_2 Laser Radar Auto Target Classifier	July 1988
(5) Complete Foliage Penetration Radar Development	September 1990

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63211F — Title: Aerospace Structures and Materials
DOD Mission Area: #553 - Engineering Technology (ATD) — Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		22,649	10,938	23,596	37,143	Continuing	N/A
69CW	Advanced Composites	6,962	2,982	7,210	17,659	Continuing	N/A
486U	Advanced Metallic Structures	8,387	7,956	12,386	14,384	Continuing	N/A
2100	Laser Hardened Materials	7,300	0	4,000	5,100	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the only Air Force program which demonstrates the application of new materials, advanced structural design concepts, new fabrication technology, and hardening techniques against high energy laser threats to Air Force systems, subsystems, and components. Metallic, nonmetallic, and laser hardened structures and components are designed and fabricated with advanced materials, new design/fabrication technology and tested to complete the technology validation process. The result is a demonstrated capability with improved structural integrity, damage tolerance, and durability, ready for weapon systems application. Direct benefits are reduced technical risk, systems cost and weight with increased systems performance and survivability. Technology is directly applicable to aircraft, missiles, tactical subsystems, and tactical space systems to defeat rapidly emerging and future threats including ground, air and space based lasers and radar targeting for surface to air missiles (SAM) and interceptors (air and space).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands)

		FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
	RDT&E	22,649	10,938	20,827		Continuing	N/A

The augmentation in funds from FY 1985 to FY 1986 is required to reestablish critical funding levels and maintain current technology development programs (only 2.7% new starts). FY 1985 was a funding anomaly caused by service funding shortfalls and the removal of Project 2100 space and tactical systems hardening from PE 63211F into PE 63233F. The tactical hardening portion was subsequently transferred back into PE 63211F in FY 1986. Other detail differences in FY 1986 include $.3 million descoping of the metal matrix demonstration program in Project 486U and cancellation of the survivable space antenna and the mission integrated transparency programs in Project 69CW for $2.8 million.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: Coordination with other Department of Defense and governmental activities is maintained under strong guidance of the Office of the Secretary of Defense's technical staff. Activities such as the Tri-Service Metal-Matrix Composite Steering Group, the Tri-Service Laser Hardening Materials and Structures Working Group, selected activities of the Office of Science and Technology Policy Committee on Materials, and bi-annual Department of Defense Materials and Structures Conferences foster development of a strong, nonredundant program. Close relationships are maintained with the National Aeronautics and Space Administration in areas of mutual interest. International coordination and cooperation is maintained through The Technical Cooperation Program (TTCP) (UK, Australia, Canada, New Zealand), and Information Exchange Programs with the UK in composites and other technologies, and specific Project Arrangements with Australia. This program element is meshed with portions of the Air Force Manufacturing Technology Program (Program Element 78011F), with results of each program element feeding the other; with Aerospace Flight Dynamics (Program Element 62201F), Materials (Program Element 62102F), and Aerospace Propulsion (Program Element 62203F) each of which provide the basic technology for further development within this program element. Due to the universal nature of materials and structures and their application, this program element has potential application for essentially every major Air Force acquisition program. There is no space system hardening effort under PE 63211F or PE 63233F because they were transferred to Space Defense Initiative (SDI) PE 63244D.

6. (U) WORK PERFORMED BY: This program is managed by the Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The five major contractors of the program include: General Electric Compa Evendale, OH (486U, 69CW); McDonnel Douglas, St Louis, MO and Huntington Beach, CA (486U, 69CW); The Boeing Company, Seattle, WA (486U, 69CW); Rockwell International, Los Angeles, CA (486U); Martin-Marietta Aerospace, Denver, CO (486U); and Sikorsky, Stratford, CT (69CW); Pratt & Whitney, W. Palm Beach, FL (69CW); Grumman, Bethpage, L.I., NY (69CW).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project 69CW, Advanced Composites. This project develops advanced composite structures technology including carbon/carbon, thermoplastic, and advanced fiber reinforced non-metallic matrices. In addition, it demonstrates enhanced survivability, reduced weight, and improved cost and durability payoff of these structures for aircraft, missile, and space system application. Further, improved vehicle performance is offered by validating advanced structures with enhanced capabilities. System survivability is greatly increased by developing structures to defeat projected threats (including radar and IR detection/tracking, nuclear, and laser). FY 1984 accomplishments are: (1) completed major graphite/expoxy (GR/EP) subcomponent durability test and full scale wing environmental/static test; (2) developed draft specification for Airframe Structural Improvement Program (ASIP) and Mil Prime damage tolerance requirements; (3) completed detailed design and initiated fabrication of H-60 supportability flight demonstration article; (4) completed detail design and tool design for F-111 horizontal stabilizer leading edge supportability design; (5) developed electromagnetic and structural radar absorber designs and conducted EM development tests

for multiple low and high temperature applications; (6) initiated demonstration of carbon/carbon 2-D thrust vectoring/thrust reversing nozzle; (7) completed detailed design of hybrid GR/EP-GR/AL optical train for advanced IR surveillance satellite application; and (8) initiated carbon/carbon space applications and survivable and maneuverable advanced satellite designs. FY 1985 goals are to: (1) complete GR/EP durability full scale test to one lifetime; (2) fabricate major components for damage tolerance tests; (3) complete fabrication and qualification test of H-60 rear fuselage supportability demonstration component; (4) complete tool fabrication and flight article fabrication of F-111 horizontal stabilizer leading edge supportability demonstration article; (5) fabricate radar absorbing structures demonstration components; (6) continue designs of carbon/carbon 2-D nozzle; (7) complete test of optical train component; and (8) continue design of carbon/ carbon space structure and survivable advanced satellite designs. FY 1986 goals are to: (1) complete damage tolerance full scale testing; (2) continue in-service evaluation of supportable composite structures (3) continue testing of radar absorbing structures components and initiate high temperature and fuselage fuel tank demonstrations; (4) fabricate carbon/carbon nozzle component; (5) fabricate carbon/carbon and advanced survivable space structure components; and, (6) initiate mission integrated transparency systems demonstration program. The $2.1M increase in 69CW budget is necessary to continue the development of advanced radar absorbing structures technology for fighter airframe and engine applications and to proceed into design development for carbon-carbon engine nozzle structures. Radar absorbing structures/materials development will provide a 1-2 order of magnitude cross section reduction, reduced weight, and demonstrated durability and damage tolerance for operational applications. Electromagnetic and structural tests of several aircraft and missile components will occur in FY 1985, 1986, and 1987. Structural carbon for two dimensional thrust vectoring/thrust reversing nozzles developments will continue with subscale nozzle tests in FY 1985 and 1986 leading to a full scale ground test and demonstration on an engine in the future.

B. (U) Project 2100, Laser Hardened Materials. This project develops and demonstrates materials along with design concepts for protection of various aerospace system components against laser radiation. Subsystems affected include satellites (optical, RF, power, thermal control, attitude controls, etc.); tactical optical and strategic/reconnaissance The project also provides personnel and aircraft critical component protection. In FY 1984 the project: (1) developed and demonstrated several new materials for space systems laser hardening; (2) demonstrated and fully tested several laser hardened space system components under the Satellite Materials Hardening (SMATH) CD-II programs including: modular attitude control system; visual indications and warning sensor, thermal bulkhead, pyro separation device, precision thermal control assembly, and star trackers; (3) determined first damage susceptibilities of second generation 2-D focal plane arrays; (4) finalized hardened design and the fabricated hardened AIM-92 seekers; (5) performed susceptibility testing of AN/AA9 Forward Looking Infrared (FLIR) hardware and LANTIRN TAS FLIR brassboard; (6) tested hardened FLIR components; (7) successfully fabricated and comprehensively tested aircrew eye protection visors; and, (8) formalized interfaces with LANTIRN, Maverick, and tactical life support SPOs. FY 1985 and outyear funding for this effort was removed from the Air Force and given to the Space Defense Initiative (SDI). Because both strategic and tactical money was taken, the Air Force intends to reprogram additional FY 1985 funds into this effort to meet tactical requirements. FY 1985 goals are to: (1) demonstrate hardened PAVETACK FLIR subsystems; (2) integrate personnel protection devices for near term threat with tactical support systems; (3) initiate the advanced seeker program; (4) demonstrate hardened Maverick missile seeker components; and, (5) initiate hardened canopy program. FY 1986 goals are to: (1) continue

tactical system hardening; (2) demonstrate hardened advanced missile seeker components; (3) demonstrate hardened Maverick missile seeker subsystem; (4) initiate aircrew protection program for evolving threat; (5) initiate reconnaissance EO systems hardening program; and (6) demonstrate hardened LANTIRN FLIR system. No strategic space system hardening efforts are under PE 63211F or 63233F because they were transferred to Space Defense Initiative (SDI) PE 63244D.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project 486U, Advanced Metallic Structures:

A. (U) Project Description: This project provides for the design, fabrication, test, and evaluation of aircraft primary and secondary structures using new metallic concepts such as metal-matrix composites, advanced powder metallurgy, and improved metal alloys. Program objectives include reduced acquisition and maintenance costs, increased structural integrity, new mission capabilities, and more efficiently performing systems. Major assemblies such as wing carrythrough structures, fuselage sections, wing structures, and others are built and tested to demonstrate that advanced technology can satisfy these objectives. The project was initiated in 1971 to address structural problems existing with operational aircraft and has been continued to demonstrate that new technology can significantly improve the structural integrity, performance capability, and reduce overall costs of current and future Air Force systems. It is the primary program supporting the Department of Defense/Congressionally directed programs in metal matrix composite technology.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Completed demonstration of silicon carbide overwrapped aluminum rocket engine. Completed fabrication of large Metal Matrix Composites (MMC) fuselage skins and subscale boron/titanium horizontal stabilizers. Established max payoff for high strength powder aluminum in fuselage applications. Demonstrated laminated A-7 leading edge with four times the durability of the production article. Demonstrated survivability of MMC engine fan blades with series of simulated bird strikes. Fabricated two 20 meter towers to demonstrate passive damping of space structures. Fabricated GR/AL tubes for space structure with a measured coefficient of thermal expansion of 0 through a temperature range of -250°F to +250°F.

(2) (U) FY 1985 Program: Major FY 1985 efforts include the completion of testing a titanium metal matrix F-15 stabilizer; fabrication of a metal matrix full scale wing component; beginning of the fabrication of a powder aluminum fighter structural component; and the completion of testing on a metal matrix missile body demonstration item.

The program to develop integral visco-elastic damping for space system structures will enter component fabrication and test. Planning has begun for a strong program to demonstrate metal matrix composites for spacecraft structural survivability, in support of the President's Space Policy and DOD Implementing Guidance. Over a ten year period, this program will validate technologies with direct application to all future space systems.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Ongoing efforts include: evaluation and testing of advanced, reinforced titanium engine fan blades, (began in FY 1982, will continue at a low level); structural verification of advanced powder metalurgy aluminum alloys (began in FY 1983) and testing of resulting fighter aircraft demonstration leading edge components and flaps which is expected to be completed in FY 1985. These materials continue to offer the potential of 20 to 30 percent improvement in strength and stiffness-to-weight ratios when compared to todays aluminum structures. Metal matrix composite programs in aluminum, two sheet fiber/titanium matrix design development, and missile/space structures payoff continue through the demonstration of full scale metal matrix aircraft wing and missile body structure components. Programs starting in FY 1986 include: metal matrix applications for Advanced Tactical Fighter structures, high temperature space structures and aircraft; evaluation and testing of advanced engine rotors; plus a new effort to develop high temperature powder aluminum structures applications for aircraft.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63215F — Title: Aviation Turbine Fuel Technology
DOD Mission Area: #553 - Engineering Technology (ATD) — Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		4,402	3,289	4,671	10,556	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides fuel processing and aircraft system hardware testing to validate aviation turbine fuel specifications for fuels derived from low quality petroleum crudes and non-petroleum sources. The program will concentrate on the hardware testing (aircraft and ground support equipment) to ensure that when fuels refined from lower quality petroleum crudes and other non-petroleum sources that are expected to be commercially available, the Air Force will be prepared to use them. The element provided the Research, Development Test, and Evaluation (RDT&E) basis for the first operational use of shale fuel in the Air Force Operational Validation Program, which is a part of the DOD program to utilize fuels incentivized by the Energy Security Act of 1980. This program supports the need to assure a domestic source for aviation fuels. Increased availability of aviation fuel translates into reduced price and offers potentially large fuel cost savings for the Department of Defense. In addition it is anticipated that the minimum cost fuel specification developed from this program will provide increased range (10-15 percent) for volume limited USAF aircraft.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,642	4,289	8,719		Continuing	N/A

EXPLANATION: (U) The FY 1985 program was reduced by Congress. The FY 1986 request was decreased because of a change in AF priority. As a result, the broadened specification petroleum fuel engine evaluation and flight test was cancelled and minimum cost fuel specification development will be delayed until FY 1992.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The exploratory development base for this program is provided by PE 62203F, Aerospace Propulsion; PE 62102F, Materials; PE 62202F, Aerospace Biotechnology; PE 62601F, Advanced Weapons. This program also supports the Air Force's Shale Operational Validation Program, PE 71112F. The program is closely coordinated with the National Aeronautics and Space Administration, Army and Navy programs through the auspices of the Office of Under

Secretary of Defense for Research and Engineering. Test fuel planning in conjunction with the Department of Energy is being coordinated through the Office of the Secretary of Defense. Test fuel acquisition, transportation, and storage is being managed by the Defense Fuel Supply Center of the Defense Logistics Agency.

6. (U) WORK PERFORMED BY: This program is managed by the Aero Propulsion Laboratory of the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. The technical effort on the program is performed by both Air Force organizations and contractors. The eight contractors involved in this program are: General Electric Engine Group, Evendale OH; Pratt & Whitney Aircraft Group, West Palm Beach FL; Boeing Military Airplane Co, Seattle WA; General Dynamics, Fort Worth TX; Solar Turbines International, San Diego CA; Garrett Turbine Engine Co, Phoenix AZ; Ashland Petroleum Co, Ashland KY; Suntech, Inc, Marcus Hook PA. Air Force in-house engine testing will be conducted by the Aero Propulsion Laboratory and the Arnold Engineering Development Center, Tullahoma TN.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) PROJECT: 63215F, Aviation Turbine Fuel Technology.

A. (U) Project Description: This program provides for the development of a new, flexible, cost-effective aviation turbine fuel specification for fuels produced from conventional petroleum, shale oil and other hydrocarbon feedstocks. The minimum cost fuel specification will provide decreases in costs and increases in availability as well as offer a significant improvement in volumetric heat of combustion which results in increased range (10 to 15 percent) for most USAF aircraft.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The assurance testing of shale derived turbine fuel was completed in 1984. This included an accelerated mission test of the fuel in the TF 30 engine, a durability test on the F100 engine main fuel pump, durability tests in jet fuel starters (T-62, JFS190), F-16 fuel system component durability tests, and flight tests in the F-16 and F-111 aircraft. Approval to proceed to the operational phase was given by the AF Chief of Staff on 9 July 1984. The procurement specification requirements were defined and transmitted to the AF Logistics Command for the shale fuel. The experimental investigation of jet fuel produced from tar sands and high density oils was initiated. Preliminary results indicate that these feedstocks are amenable to the production of a minimum cost high density fuel which potentially could provide a 10-15 percent range for USAF aircraft. A comprehensive survey of the refinery industry was completed which indicates that appreciable feedstocks are available for the production of high density aviation turbine fuel at reasonable costs.

(2) (U) FY 1985 Program: The production and characterization of jet fuel produced from tar sands, high density oils, and other chemical feedstocks and refinery sidestreams will continue. Quantities of high density fuels sufficient for turbine engine combustor testing will be produced. Tests of operational engine combustors will be

initiated to assess the impact of high density fuel properties such as surface tension, viscosity, and specific heat on performance. The broadened petroleum fuel specification will not be initiated because of budget constraints. This interim fuel offered the advantage of lower cost and greater availability in the near future (1987). The program is now focused on the development of a final minimum cost fuel specification to allow the AF to take advantage of the high density feedstock of the future.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continue the combustor tests to assess the impact of the use of high density fuel on operational USAF engine combustor systems. Initiate tests of high density fuels in the hot section components of advanced turbine engines, i.e., Joint Advanced Fighter Engine (JAFE). Initiate tests to assess the impact of the use of high density fuels in aircraft fuel system components. Conduct trade-off analyses to assess impact of the use of high density fuels in operational USAF aircraft. Costs are based on program office estimates from past contractor experience on similiarly structures programs. (Category IV).

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) Tar Sands/High Density Oil Processing	September 1985
(2) Engine and Flight Test Minimum Cost Fuel	March 1991
(3) Issue Final Minimum Cost Fuel Specification	September 1991

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63216F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Advanced Turbine Engine Gas Generator (ATEGG)
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		24,532	25,302	29,656	33,713	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program ensures that there is a continuous development and demonstration of the most advanced turbine engine high pressure core components. Advanced compressors, combustors and high pressure turbines are integrated into gas generators in which the durability, cost and performance aspects of these core engine technologies can be assessed. A building block approach is utilized to systematically assess both the independent component characteristics and the interactive, interdependent component characteristics under the most realistic operating environment. This critical integrated hardware demonstration enhances the early low risk transition of these technologies to engineering development and provides a needed basis for further advances in core component technology. Advanced aircraft and/or growth aircraft syatems are dramatically affected by propulsion related capability such as durability, reliability, life cycle cost and performance. These features are directly translated to thrust/weight, specific fuel consumption at cruise and in afterburner, stall-free operation, matched cycle performance within a mission envelope, ease of maintenance, lower acquisition cost, and increased reliability and durability. Proper attention to these propulsion features will ensure that advanced aircraft systems can achieve longer range, higher payload, increased maneuverability, increased sortie rate and improved operability in affordable configurations.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	25,132	25,454	34,460		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Gas generator and other engine component feasibility and practicality is demonstrated initially in Exploratory Development under Program Element 62203F, Aerospace Propulsion. The other engine subsystems such as fans, controls and afterburners which when added to the basic gas generator, complete the engine, are demonstrated in advanced development under Program Element 63202F, Aircraft Propulsion Subsystems Integration (APSI).

Close coordination will be continued with the Navy, Army and NASA to ensure that resources are effectively utilized for common needs. Current and planned development efforts by the Navy Advanced Propulsion Program 63210N, Aviation Turbine Fuel Technology Program 63215F, Materials 62102F, Industrial Preparedness Program 78011F and Aerospace Structure and Materials Program 63211F directly complement ATEGG effort.

6. (U) WORK PERFORMED BY: The program is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Four turbine engine contractors are currently involved in this effort: Teledyne CAE, Toledo, OH; General Electric, Evendale, OH; Pratt and Whitney, West Palm Beach, FL; and Garrett Turbine Engine Co., Phoenix, AZ.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63216F, Advanced Turbine Engine Gas Generator (ATEGG)

A. (U) Project Description: This Advanced Development Program will ensure that turbine gas generator technology is available to meet the requirements of future aircraft propulsion systems. To ensure that these needs can be met requires a better definition of the engine's operating environment. Trade-offs between performance and life characteritics within this environment lead to advanced designs, and effective test and measurement techniques verify this capability. The gas generator is the basic building block of the engine and it consists of a compressor, a combustor, and a turbine to power the compressor. The objective of this program is to provide the continued evolution of the most advanced core engine technologies (compressors, combustors, and high pressure turbines) into an advanced gas generator in which the performance, cost and durability aspects can be assessed in a real engine environment. This critical hardware demonstration will enhance the early low risk transition of these technologies to engineering development where they can be applied to growth systems and/or new systems. The technologies are scalable, flexible, and applicable to a wide variety of potential systems applications. Flight size, flight weight gas generators are initially tested to define flowpath characteristics. Once the flowpath has been characterized and mechanical integrity verified, the gas generators are subjected to accelerated life testing to characterize the structural aspects of the advanced component designs. New component technologies are introduced on a step-by-step basis so that their individual performance/structural characteristics can be assessed. This will also allow the relationship (effect) of the new component on other components and the integrated gas generator to be accurately assessed.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: During this time period, advanced development efforts included the initial assessment of two new large engine high-through-flow (HTF) gas generator designs which offer up to a 60 percent reduction in stages/parts count and a threefold improvement in life compared to current core engines. Dedicated structural tests were conducted to assess advanced components, concepts, materials and manufacturing processes.

Close coordination will be continued with the Navy, Army and NASA to ensure that resources are effectively utilized for common needs. Current and planned development efforts by the Navy Advanced Propulsion Program 63210N, Aviation Turbine Fuel Technology Program 63215F, Materials 62102F, Industrial Preparedness Program 78011F and Aerospace Structure and Materials Program 63211F directly complement ATEGG effort.

6. (U) WORK PERFORMED BY: The program is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Four turbine engine contractors are currently involved in this effort: Teledyne CAE, Toledo, OH; General Electric, Evendale, OH; Pratt and Whitney, West Palm Beach, FL; and Garrett Turbine Engine Co., Phoenix, AZ.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63216F, Advanced Turbine Engine Gas Generator (ATEGG)

A. (U) Project Description: This Advanced Development Program will ensure that turbine gas generator technology is available to meet the requirements of future aircraft propulsion systems. To ensure that these needs can be met requires a better definition of the engine's operating environment. Trade-offs between performance and life characteritics within this environment lead to advanced designs, and effective test and measurement techniques verify this capability. The gas generator is the basic building block of the engine and it consists of a compressor, a combustor, and a turbine to power the compressor. The objective of this program is to provide the continued evolution of the most advanced core engine technologies (compressors, combustors, and high pressure turbines) into an advanced gas generator in which the performance, cost and durability aspects can be assessed in a real engine environment. This critical hardware demonstration will enhance the early low risk transition of these technologies to engineering development where they can be applied to growth systems and/or new systems. The technologies are scalable, flexible, and applicable to a wide variety of potential systems applications. Flight size, flight weight gas generators are initially tested to define flowpath characteristics. Once the flowpath has been characterized and mechanical integrity verified, the gas generators are subjected to accelerated life testing to characterize the structural aspects of the advanced component designs. New component technologies are introduced on a step-by-step basis so that their individual performance/structural characteristics can be assessed. This will also allow the relationship (effect) of the new component on other components and the integrated gas generator to be accurately assessed.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: During this time period, advanced development efforts included the initial assessment of two new large engine high-through-flow (HTF) gas generator designs which offer up to a 60 percent reduction in stages/parts count and a threefold improvement in life compared to current core engines. Dedicated structural tests were conducted to assess advanced components, concepts, materials and manufacturing processes.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63217F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Weapon Systems Power
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		0	0	1,947	10,398	Continuing	N/A
3033	Electronic Warfare and Space-Based Surveillance Power	0	0	100	2,510	Continuing	N/A
3034	Space Power System	0	0	100	2,432	Continuing	N/A
3035	Aircraft Power Systems	0	0	1,067	3,600	Continuing	N/A
3036	Missile Systems Power	0	0	680	1,856	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This FY 1986 new start program was established to develop enabling technologies to give the Air Force the capability of providing the large quantities of specially conditioned electrical power required by advanced electronic warfare, surveillance, and communication systems. This program is the singular Air Force effort in the area of systems level integration of advanced power source and power conditioning, and power system thermal management technologies which are required to achieve the system weight and volume goals for advanced aerospace applications. This program also provides advanced firepro f hydraulic power system technology to enhance operational capabilities of future tactical and strategic aircraft. Low cost battery technology for tactical missiles and high performance battery technology for strategic missiles will also be established. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Costs
RDT&E	0	1,000	2,990		Continuing	N/A

EXPLANATION: Congressional denial of FY 1985 funds, FY 1986 restart.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This program supports multiple weapon system developments in the areas of airborne electronic warfare, tactical aircraft, tactical/strategic missile weaponry, and space-based surveillance. It provides an avenue for integrating power system component technologies developed under PE 62203F, Aerospace Propulsion, and PE 63401F, Advanced Spacecraft Technology. This program has been directly coordinated with recipient Air Force Systems Command (AFSC) product divisions; Space, Armament, and Aeronautical Systems, and Electronic Systems; to insure timely technology availability for incorporation in major weapon systems such as the next generation fighter, Advanced Medium Range Air-to-Air Missile (AMRAAM) variants, and space-based radar.

6. (U) WORK PERFORMED BY: The work is managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, Ohio. The majority of this program will be conducted contractually through multi-source competitive procurement actions. This is a FY 1986 new start program and specific contractors have not yet been identified.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3033, Electronic Warfare and Space-Based Surveillance Power. The enabling pulse power supply technology for space-based surveillance systems will be developed in this project. It will provide enabling power system integration technology to couple the power source efficiently to the electrical load. Present system level power densities (4-6 watt/lb) would render space-based surveillance capabilities infeasible due to excessive weight. Projected power system goals of 11 watt/lb will allow single launch capability and eliminate on-orbit assembly. The surveillance systems affected by this project are lower altitude and considerably lower power level surveillance systems than the SDI systems. The technologies to accomplish the missions addresued in this project are different than those being pursued by SDI. This project will also provide high power generation, conditioning and distribution technology for advanced airborne electronic warfare such as high power countermeasures technology. FY 1986 and planned efforts include initiation of preliminary design studies for the Space-Based Surveillance Power System.

B. (U) Project: 3034, Space Power Systems. This project will provide enabling power systems technology for most of the space missions as described in the Military Space Systems Technology Plan (MSSTP) where power levels greater than present capability (less than 5kW) are required. This project will provide for integration of advanced solar array/battery power systems where thermal considerations will become critical at these higher power levels and will require a total power system perspective. SDI is planning for power levels greater by approximately a factor of 10 for their systems. SDI will use and pursue technologies for different power sources which require different integration techniques than those being developed in this project. This is a FY 1986 new start project and planned efforts include trade-offs studies, analysis, risk/requirements, and assessments to determine technologies to be pursued.

C. (U) Project: 3035, Aircraft Power Systems. This project will develop and demonstrate a nonflammable hydraulic power system for advanced tactical and strategic aircraft. The demonstration of this technology in an 8000 psi system will facilitate the application of thin wing technology and provide significant weight savings for the next generation fighter. FY 1986 efforts will include design, fabrication, and testing of hydraulic systems components to be used in the ground based technology demonstrator.

Program Element: #63217F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Weapon Systems Power
Budget Activity: #2 - Advanced Technology Development

D. (U) Project: 3036, Missile Systems Power. Power source technology required by advanced tactical and strategic missile weaponry will be developed here. This multitask project will provide new lithium thermal battery technology for advanced tactical missiles and enabling power source technology for an electrically propelled remotely piloted vehicle. FY 1986 efforts entail initiation of "Tactical Missile Low Cost Battery." A preliminary design of silver-zinc replacement battery for the GBU-15 will be completed. Development of this type of battery technology represents life cycle cost savings of $100 million-$400 million for Air Force applications and a potential $4.0 billion savings DOD wide through lower initial cost and improved storability and maintainability. Spin-off technology will also provide for an extended operational life battery for Advanced Medium Range Air-to-Air Missile configurations.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63226F Title: DOD Common Programming Language (Ada)
DOD Mission Area: #551 - Electronic and Physical Sciences (ATD) Budget Activity: #2-Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		7,762	8,055	7,460	6,995	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is part of the total DOD effort to implement, introduce, and provide life-cycle support for Ada, the DOD common, high-order programming language for mission critical computers. It will provide resources to meet those language support requirements which are common to the various services and agencies. It will provide for configuration control of the Ada language, enforcement of standardization via compiler validation, educational promotion, development of Ada Programming Support Environments (APSE), and accelerated development of Ada responsive life-cycle software development tools and methodologies.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	7,762	8,055	7,624		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The Ada Program is managed by the DOD Ada Joint Program Office (AJPO) through coordination with the services. The AJPO is responsible for the common Ada-related needs of the DOD, and the components are responsible for component specific needs. For example, rehosting/retargeting of Ada Programming Support Environment software to a component specific architecture is the responsibility of the components. Each component has developed an introduction strategy and is responsible for implementation of that strategy. Related program elements supporting component specific Ada needs are: PE 64740F Computer Resources Management Technology, PE 63728F Advanced Computer Technology, PE 63723A Command and Control, PE 62746A Tactical Automated Data Processing Technology and PE 63526N Advanced Computer Technology. In addition to the above, work performed under this program element (PE 63226F) is the basis for some efforts planned under the DOD software initiative, PE 63756A Advanced Software Technology (STARS) and under PE 63752F the DOD Software Engineering Institute.

6. (U) WORK PERFORMED BY: The Ada Joint Program Office is responsible for all work performed under this program element. Specific efforts are conducted by each Service for service unique requirements. Major contractors are Honeywell, Minneapolis, MN for the support of work related to achieving international standardization of Ada; Softech, Boston, MA for the development of Ada compiler validation tests and tools as well as supporting compiler

validation activities at the Language Control Facility, Wright-Patterson AFB, OH; Intermetrics, Boston, MA for the development of the Ada Integrated Environment; Illinois Institute of Technology Research Institute, Chicago, IL for operation and support of the Ada Information Clearinghouse; Virginia Polytechnic Institute, Blacksburg, VA for the development of an operational model of the Common Ada Programming Support Environment APSE Interface Standard (CAIS). In addition, at various times there are between 5 and 25 additional contractors performing on contracts that are funded in part or wholely under this program element.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 63266F, DOD COMMON PROGRAMMING LANGUAGE (ADA)

A. (U) Project Description: DOD computer software life-cycle costs are measured in the billions of dollars. Inflation and increased applications of computers to new functions threaten to make software an even more substantial portion of the DOD budget. The DOD recognizes that use of a common, high order language and a modern programming support environment coupled with modern programming practices will provide leverage to control the cost and improve the reliability of software. In 1975, the Director, Defense Research and Engineering (DDR&E), established the High Order Language Working Group (HOLWG), with representatives from the Army, Navy, Air Force, Defense Communications Agency (DCA), National Security Agency (NSA), and Defense Advanced Research Projects Agency (DARPA), to investigate the feasibility of adopting a common, high order computer language for use in embedded computer systems. By July 1980, the HOLWG had successfully published a formal definition of the new standard DOD computer programming language, Ada. On December 12, 1980, the Under Secretary of Defense for Research and Engineering established the Ada Joint Program Office (AJPO) attached to the Office of the Deputy Under Secretary of Defense (Acquisition Policy). The AJPO Charter assigns to the AJPO three major tasks: (1) the AJPO must ensure the implementation and maintenance of Ada as a consistent unambiguous standard recognized by the DOD and also by the widest possible community; (2) the AJPO must ensure the smooth introduction and acceptance of Ada in the DOD as early as possible consistent with the needs of individual components; (3) and the AJPO must ensure the provision of life cycle support for Ada through the development of a robust Ada Programming Support Environment (APSE) to improve productivity both in development and in continued evolution. Ada is an important advancement for DOD software technology. The major programming language innovations of the last ten years have been consolidated and unified in a language which meets the needs of nearly all DOD applications. By transitioning to a single, modern, high order language in defense systems, DOD will derive significant benefits in the areas of training, compiler and programming tool availability, software maintainability and reduction of other software development costs. PE 63226F funds the remaining service and agency common tasks in the Ada program needed to successfully complete this transition.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: An Ada Compiler Validation Facility was established at Wright-Patterson Air Force Base with preparations continuing for facilities in the General Services Administration and in Europe. Ada video

tape course/presentations were completed and distributed. A Catalog of Resources for Education in Ada Software Engineering (CREASE) was completed and distributed to the public. A preliminary version of the Ada Language System was distributed to industry for test and rehost efforts. NATO and International Organization for Standardization (ISO) activities to adopt Ada are progressing well with the latest achievement being the establishment of Working Group 14 under ISO to nominate Ada as an international standard. As of Fiscal Year 1984, there were five validated Ada compilers. Ada capability was made available for users to experience on the Advanced Research Projects Agency Network (ARPANET) and a preliminary Version 2 of a Common Ada Programming Support Environment Interface Standard (CAIS) was presented for public review. The CAIS will enable use of Ada applications programs, data bases and development tools on different Ada Programming Support Environment. The Ada life-cycle methodology document is nearing completion and the development of life-cycle methodology tools to automate the definition of Ada software requirements, costing models and metrics techniques were initiated. Ada use in DOD and industry continues to expand with industry reporting 600 to 900 percent productivity gains using Ada. The development of an Ada usage guide was started.

(2) (U) FY 1985 Program: Standardization procedures toward establishing Ada as a NATO and ISO standard will continue with the aim of achieving one or both of these standards by the end of FY 1985. Compiler validation will continue in even greater numbers and compiler validation technology will be enhanced. The user's guide for the Ada language will be completed along with trial demonstrations of Ada in general purpose automated data processing applications. Initiatives in military training will be supported as well as incentive grants to universities, community colleges, and high schools to pursue software engineering education with Ada. Development of the Version 2 CAIS standard will be completed and modification of the Ada Language System (ALS) to accommodate the CAIS initiated. The initial Ada Integrated Environment (AIE) will be available by the end of FY 1985. Life-cycle methodology tools and techniques development to support software design, coding, test and maintenance will be transferred to the STARS Reusable software techniques will be promoted. Significant use of Ada in DOD program systems development is anticipated by the end of FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Standardization procedures to establish Ada as a NATO and ISO standard not consummated in FY 1985 will continue. Preparations will begin for the evolutionary changes of the Ada standard required by American National Standards Institute (ANSI) procedures. Evolutionary enhancement of compiler validation technology to enforce the Ada standard will continue. Educational initiatives in the academic community will be heavily emphasized and Ada education techniques will be incorporated into an APSE based Ada course. Development of CAIS Version 3 will be underway along with refinement of the intermediate language standard for Ada compiler/machine language interface application. Incorporation of CAIS standards into the AIE and ALS will be underway along with evaluation and validation technologies to measure and enforce Ada software development and environment quality and standards. Several life-cycle methodology tools in various states of completion will be applied on DOD programs using Ada. Use of Ada will expand, and based on current industry estimates, the Ada software market will grow to $910 million in FY 1986.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Initial Ada Compiler Validation Capability Completed	December 1982
(2)	(U)	ANSI Standard Established	February 1983
(3)	(U)	First Ada Compiler Validated	March 1983
(4)	(U)	Ada Video Tape Course Available	July 1984
(5)	(U)	Life-Cycle Methodology Tools Transfer to STARS Program	September 1985
(6)	(U)	Initiate Technology Insertion Effort	September 1985
(7)	(U)	Complete Ada Educational Experiences	September 1986
(8)	(U)	Air Force Ada Programming Support Environment Available	September 1986
(9)	(U)	ISO and NATO Standardization Consummated	September 1987
(10)	(U)	ANSI Standard Five Year Revision	February 1988

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63227F | Title: Advanced Simulator Technology
DOD Mission Area: #522 - Environmental and Life Sciences (ATD) | Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8,236	7,486	4,410	8,094	Continuing	N/A
2363	Advanced Visual Technology System	7,390	5,960	3,130	6,267	Continuing	N/A
2743	Advanced Simulator Concepts	846	1,526	1,280	1,827	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Science and Technology Program supports simulator and training device technology and develops subsystems to improve the performance capabilities of flight simulators. Currently, air-to-air, air-to-ground and terrain-following fighter aircraft simulator training is severely limited by the lack of visual scene detail and complexity, and display brightness, resolution and field-of-view (FOV). Thus, there is a special emphasis in this program on developing and demonstrating improved visual image generation and visual display technologies in order to provide more adequate visual scenes for combat mission training. In the image generation area, advanced image generation technology, with greatly enhanced scene detail and complexity, is being implemented and evaluated. In the visual display area, significant improvements in display resolution, brightness and FOV are still being developed in response to critical Tactical Air Force training requirements. In FY 1985 and beyond, $1,100 thousand of Project 2743 will be used to fund the Air Force portion of the tri-service Training Data Analysis Center.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,698	7,486	4,507		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Military Construction: Funds	0	0	0	3,872	0	3,872

5. (U) RELATED ACTIVITIES: Related program elements: 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; 62202F, Aerospace Biotechnology; and 63751F, Training Systems Technology; 64227F, Flight Simulator Development; 63738A, Non-Systems Device Development; 63216A, Synthetic Flight Simulators; 62757N, Human Factors and Simulation Technology; 63733N, Training Device Technology; and 63720N, Education and Training. There is a

continuing interface and close coordination among the Army, Navy, and Air Force on training simulation. The Air Force Human Resources Laboratory as the Air Force Systems Command focal point for training simulation technology, closely monitors all significant research and development being conducted by other Department of Defense, National Aeronautics and Space Administration, and industrial organizations in order to prevent duplication. Close coordination within the Air Force user community is also accomplished by annual research and development coordination meetings between the Air Force Human Resources Laboratory, the Aeronautical Systems Division, and the Major Commands.

6. (U) WORK PERFORMED BY: This program is performed by the Air Force Human Resources Laboratory through the Operations Training Division (AFHRL/OT), Williams Air Force Base, AZ. The contractors are: Singer Co, Binghamton, NY (Projects 2363 and 2743); General Electric Company, Daytona Beach, FL (Projects 2363 and 2743); Univ of Dayton, Dayton, OH (Projects 2363 and 2743); Gould SEL Computer Systems, Ft Lauderdale, FL (Projects 2363 and 2743); and Canadian Commercial Corp, Ottawa, Canada (Project 2743).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2363, Advanced Visual Technology System. This project will develop and install an advanced R&D visual system prototype on the Advanced Simulator for Pilot Training (ASPT). The Advanced Visual Technology System (AVTS) represents a two-pronged approach to advancing state-of-the-art visual simulation technology and demonstrating the utility of this technology for critical Tactical Air Force (TAF) training requirements. One effort is developing an advanced 10-channel R&D computer image generation (CIG) system that will meet the TAF training requirements for scene detail and complexity. Another will develop a prototype visual display capable of meeting the demanding TAF training requirements for a wide field-of-view (FOV), high resolution, and high brightness display. This display capability is necessary to enable tactical size targets to be detected and identified at sufficient ranges that realistic training can be provided. The combination of the advanced CIG and visual display systems will produce a research simulator adequate to demonstrate and behaviorally define the TAF simulator training requirements. The simulator visual design issues which will be evaluated with regard to their contributions to training and cost effectiveness are: texturing, point feature density, object spacing and utilization, general data base complexity and data requirements, maximum range for cue generation, shadows and brightness gradients, planar versus non-planar terrain, edge smoothing, area of interest implementation (for fine detail), visual FOV, color, contrast, display persistence, display resolution, geometric distortion, inter-channel mismatch, and disparities between visual displays and other cockpit displays (sensor, radar, etc.). In FY 1984, the development, fabrication and delivery of six channels of the advanced CIG was completed. The six AVTS CIG channels were installed on the ASPT and engineering tests and evaluations started. In FY 1985, four additional CIG channels will be installed on the ASPT. These channels will also incorporate an advanced texturing capability, called cell texturing, which greatly improves scene detail. The cell texturing development was primarily funded by an Army add-on to this project, as was a limited FOV dome visual display system to be installed at AFHRL/OT in FY 1985. Interim color light valve displays will be used on the Advanced Simulator for Pilot Training (ASPT) to commence training effectiveness R&D using the Advanced Visual Technology System (AVTS) and obtain answers to many of the research issues listed above. Development will start on an advanced dome visual display system for large simulators such as the ASPT. Development of the second generation fiber-optic helmet mounted display

(FOHMD) will continue. Both display systems will use imagery generated by the AVTS computer image generation (CIG) system for training effectiveness evaluations. The main emphasis in FY 1986 will be on the developement of advanced dome and helmet-mounted visual display systems. Manufacture of a full field-of-view (FOV) dome visual display for large ASPT type simulators will continue. The second generation FOHMD will be completed and evaluated. Development will start on a third generation FOHMD with eye-slaved high resolution imagery. Although the FOHMD technology is more radical and, therefore, more risky in its approach, initial demonstrations of this technology are very encouraging. In FY 1987, the prototype dome display system will be completed. The third generation FOHMD will be completed in FY 1988.

B. (U) Project: 2743, Advanced Simulator Concepts. This project will advance flight simulation concepts by developing advanced training technologies for tactical aircraft. This training will require multisensor, multicockpit combat mission simulators. The required simulator capabilities will be initially demonstrated using the ASPT and the AVTS when the advanced higher brightness, high resolution visual display system is installed. A Low-Altitude Navigation and Targeting Infrared System for Night (LANTIRN) R&D sensor simulation capability will provide the basic multisensor simulation technologies. During FY 1984, development of the LANTIRN multisensor simulation capability continued. This simulation capability will provide for multisensor simulation R&D as well as initial LANTIRN training for TAC. A breadboard fiber optic helmet-mounted display was evaluated and specifications were developed for a more advanced model. The helmet-mounted display was jointly funded by the U.S. and Canadian Governments. Beginning in FY 1985, the helmet-mounted display work was transferred to Project 2363 to consolidate all of the display related efforts in one project. During FY 1985, initial design efforts for a multisensor, multicockpit combat mission training capability at AFHRL/OT will start. These efforts will provide system specifications for the number of cockpits, type of visual and sensor systems, instructor-operator station, and other simulation subsystems. During FY 1986, this initial design effort will be completed and a prototype multicockpit instructor operator station development will start. Active development of multicockpit combat mission training simulators will start in FY 1987 and be completed in later years. In FY 1985, FY 1986, and FY 1987, $1,100 thousand will be used each year to fund the Air Force share of a tri-service Training Data Analysis Center (TDAC).

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63231F
DOD Mission Area: #552 - Environmental and Life Sciences (ATD)

Title: Crew Systems Technology
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		6,866	10,200	12,754	16,147	Continuing	N/A
2829	Cockpit Automation Technology	1,300	3,916	4,700	7,779	Continuing	N/A
2830	Advanced Life Support Systems	3,400	2,600	2,624	1,904	Continuing	N/A
2868	Crew Escape Systems Technology	2,166	3,684	4,730	5,016	Continuing	N/A
2992	Space Biotechnology	0	0	700	1,448	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Information available for the system operator concerning the status of the weapon system is so complex and fluid that it can exceed his ability to perceive, decide, and act upon the information. Modern aircraft tactics and mission scenarios continually place the operator in environments from which there is low probability of successful escape in an emergency. This program element has been established to provide advanced development and demonstration of concepts to protect and extend the performance of the crewman in the aerospace environment. Performance capabilities of human operators in manned military spaceflight will be examined through demonstrations exploiting the space shuttle in conjunction with the space test program. It will demonstrate the capability to safely egress aircraft at the extremes of the performance envelope and will develop the methodology to maximize decision making by the system operator/manager. This is a Science and Technology Program. The efforts in this program do not duplicate any tasks conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,866	10,726	13,634		Continuing	N/A

The Congress denied funds in FY 1985 for Project 2992, Space Biotechnology, under program element 63365F. It is included here as a FY 1986 restart.

4. (U) OTHER APPROPRIATION FUNDS: None.

5. (U) RELATED ACTIVITY: These projects interact with materials and electronics technology development conducted in other laboratories. Formal agreements exist and joint participation in steering groups assure development phasing of

the goals are compatible. Technology will transition to the Aeronautical Systems Division, principally the Life Support Program Office, for full-scale engineering development. The transition plans have been fully reviewed by Aeronautical Systems Division and included in the Ten Year Life Support Master Development Plan. Spaceflight activities are fully coordinated between National Aeronautics and Space Administration and Air Force Space Command to explore the utility of manned military space missions. In addition, life support activities of the three military services are coordinated through the Tri-service RDT&E Steering Group reporting to the Joint Logistics Commanders. Laser protection technology is coordinated additionally through the Tri-Service Laser Hardened Materials and Structures Group chaired by Office of Under Secretary of Defense Research and Engineering.

6. (U) WORK PERFORMED BY: The Crew Systems Technology Program is conducted by the Aerospace Medical Division, Directorate of System Acquisition with assistance from its laboratories, the United States Air Force School of Aerospace Medicine, Brooks AFB TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH; and, through Memoranda of Agreement with other laboratories, divisions, and commands. Major contractors are: Boeing Military Airplane Company, Seattle WA (Projects 2830, 2868); BDM Corporation, Dayton OH (Project 2829); Bolt Beranek and Newman Inc., Cambridge MA (Project 2829); McDonnell Aircraft Co., St Louis MO (Project 2829); McDonnell Douglas Corporation, Douglas Aircraft Company, Long Beach CA (Project 2868).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2829, Cockpit Automation Technology (CAT). This project will develop and validate quantitative procedures to permit the extensive application of human factors design principles early in the development cycle of manned airborne weapon systems. The project will greatly improve cockpit engineering change proposals and retrofits. For the first time, a coordinated weapon system design process will permit trade-offs between airframe, avionics and cockpit design in advance of Full Scale Development decisions, as well as provide insight into the adequacy of the design after potential downstream avionics and weaponry modifications. Military standards, design handbooks and extensive computer-assisted procedures will be made available to the military services, National Aeronautics and Space Administration and contractor personnel. In December 1983, a jointly staffed Aerospace Medical Division and Air Force Wright Aeronautical Laboratories Advanced Development Office was formed at Wright-Patterson AFB OH to develop detailed functional descriptions of air-to-ground and air-to-air mission scenarios for late 1990s tactical operations. Three competing contractor teams will design a version of the CAT methodology. In March 1984 the Advanced Tactical Fighter System Program Office agreed to support the project and use the resulting methodology. A draft Technology Transition Plan was submitted to the Directorate of Equipment Engineering at Aeronautical Systems Division to initiate the process of institutionalizing the resulting methodology. In 1985 the three contractors will each develop detailed prototype cockpit design process descriptions, including functional specifications of the tools and procedures requiring further development or modification. The contractors will begin the demonstration of the front-end analytic portion of their recommended methodology through the use of computer-based techniques. Based on contractor recommendations and the success of the demonstration, a detailed design process will be determined by government personnel to support a development/validation phase beginning in FY 1986. This phase will further develop the data bases, design tools and

software and will demonstrate the process through full mission simulation and validation tests. The FY 1986 effort will be conducted through competitive contract award early in the year.

B. (U) Project: 2830, Advanced Life Support Systems (ALSS). The objective of the ALSS project is to provide integrated protection for aircrew to the extremes of the performance envelope of modern aircraft and mission scenarios. The concepts to be developed and demonstrated will provide protection for emergency descent from altitudes up to 60,000 feet, for sustained acceleration of nine G, for cockpit temperatures to 122°F (50°C), and also provide vision protection for known laser and nuclear flash threats. Current equipment provides no protection from elevated cockpit temperatures and limits altitude protection to only 50,000 feet. Acceleration protection does not match the performance capabilities of current fighter aircraft such as the F-16. Phase I, Preliminary Design, was completed on schedule in the third quarter of FY 1984. During this phase, the contractor analyzed various design alternatives for the integrated ensemble and peripheral equipment. Technological approaches selected to proceed into Phase II, Detailed Design, were positive pressure breathing with chest counterpressure, uniform lower body pressure driven by an electronic anti-G valve, multifunction seat-mounted oxygen regulator, innovative molecular sieve oxygen generator, liquid thermal cooling, and enhanced head/eye protection. Phase II was initiated in third quarter FY 1984 and will progress into FY 1985. Detailed design phase is scheduled for completion in the third quarter of FY 1985. Throughout this phase the prime contractor will solicit subcontract bids based upon critical item specifications developed early in FY 1985. Hardware buildup will commence in Phase III, Fabrication Phase, and continue into FY 1986. Activity for the year will concentrate on certification for human use, ground tests, and preparation for flight tests of the integrated ensemble. Subsystem testing of individual components will be a major task in the early part of this phase. After components have been fabricated and tested on a subsystem basis, they will be delivered to the prime contractor in mid FY 1986 for system tests. The contractor is scheduled to deliver three complete sets of system hardware to the USAF School of Aerospace Medicine for extensive evaluation. Phase III is scheduled to conclude in the fourth quarter of FY 1986 followed immediately by the start of Phase IV, Flight Demonstration Phase. Phase IV will continue into FY 1987 with training of flight demonstration aircrew members and eventually progressing into actual flight aboard modified aircraft.

C. (U) Project: 2868, Crew Escape Technology (CREST). The Crew Escape System Technology (CREST) program will integrate advanced subsystems concepts into a generic ejection seat capable of protecting aircrew throughout the performance envelope of modern air frames. It is to reduce fatality and major injury rates in emergency ejections at all speeds between 0 and 700 knots equivalent air speed (KEAS) especially with adverse attitude at low altitude. The CREST program will demonstrate an ejection seat escape capability for aircraft of the future, but many of these technologies will also permit upgrading of existing ejection seats. Concepts of passive windblast protection under high dynamic pressure (1600 Q), limb restraint, stabilization, and continuous adaptive control have transitioned from exploratory development projects in FY 1984 for demonstration in the CREST project. Phase I is being conducted by two competitive contracts awarded in May 1984. Trade-off studies were accomplished, subsystem specifications were developed, and an operational escape system performance baseline was established. Preliminary Design continues under competitive contracts up to the Systems Design Review (SDR) scheduled for July 1985. At this time the government may

select both contractors or downselect to one to continue into Phase II in FY 1986. Phase II, Subsystem Development, will develop and test novel subsystems under laboratory conditions to verify design assumptions and prepare test fixtures for full system testing.

D. (U) Project: 2992, Space Biotechnology. Military space biotechnology addresses man-machine integration and crew protection in the military space environment. The program objective is to exploit and optimize the utility of human operators in military space mission areas such as logistics support, force enhancement and system command and control for comparison with unmanned systems. In the near term the effort will transition NASA technology to quantify man's capabilities in numerous generic military missions and to assess crew protection needs and vulnerability in military space environments. It will exploit the shuttle to evaluate potential roles and quantify space induced changes in human capabilities using existing procedures of the Space Test Program and the current Memorandum of Agreement with NASA. In the far term the effort demonstrates designs to further expand system capabilities by employing effective man-machine interface designs. This effort will start in FY 1986 with contract award.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63244F
DOD Mission Area: #225 - Air Warfare Support

Title: Aircraft Nonnuclear Survivability
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,667	3,931	3,278	3,508	Continuing	N/A
2251	Survivability Technology Development	1,858	1,789	1,892	2,144	Continuing	N/A
2899	Aircraft Battle Damage Repair Advanced Development Program	809	2,142	1,386	1,364	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element provides for Air Force participation in the Joint Logistics Commanders' Joint Aircraft Survivability Program. The Naval Materiel Command and the Army Materiel Development and Readiness Command are co-sponsors and contributors to the Joint Aircraft Survivability program. The program develops standard vulnerability and survivability assessment methodology, design guidance and technology for improving the combat survivability of United States aircraft to nonnuclear threats. Additionally, this program provides the resources for the Air Force Aircraft Battle Damage Repair (ABDR) Advanced Development program which develops aircraft battle damage repair methodology and improved rapid repair techniques and materials to increase wartime aircraft availability and sortie rates. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,895	3,931	3,350		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: The Joint Aircraft Survivability program is related to complementary programs of the Navy and Army accomplished under PE 63262N (Aircraft Survivability and Vulnerability) and PE 63215A (Joint Survivability Investigation). The Aircraft Battle Damage Repair program is related to a similiar Army effort accomplished under PE 63209A, Aircraft Battle Damage Repair. The program also advances survivability and aircraft battle damage repair

efforts from Aerospace Flight Dynamics (PE 62201F), Aerospace Propulsion (PE 62203F), Materials (PE 62102F), and Aerospace Avionics (PE 62204F). The Aircraft Battle Damage Repair program is accomplishing development of a battle damage assesment aid in cooperation with the Training Systems Technology Program, PE 63751F, project 2362, and is collecting Israeli Aircraft Battle Damage Repair (ABDR) data for use in development of an ABDR resource quantification methodology under the Logistics System Technology Program, PE 63106F, project 2745. Coordination of effort is through a central management office of the Joint Technical Coordinating Group on Aircraft Survivability which is manned by an officer from each command represented on the Joint Logistics Commanders Group. Duplication is avoided through joint reviews by that office and the individual service task agencies.

6. (U) WORK PERFORMED BY: Technical management performed by Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. Major contractors are Perceptronics, Woodland, CA (2899); The Boeing Company, Seattle, WA (2251); Pratt & Whitney, West Palm Beach, FL (2251); Booz Allen Applied Research, Bethesda, MD (2251); and Georgia Institute of Technology Research Institute, Marietta, GA (2251). There will be seven additional contractors, with a total dollar value of $1,522,000.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2251, Survivability Technology Development. This project funds the Air Force share of the approved Tri-service program in Aircraft Nonnuclear Survivability established by the Joint Logistics Commanders and directed by the Joint Technical Coordinating Group for Aircraft Survivability (JTCG/AS). It involves: (1) the coordination of individual service programs to increase the survivsbility of aeronsutical systems in a nonnuclear threat environment; (2) development efforts to complement the Service's survivability programs in the area of technology, assessment methodology, design criteria and specifications and standards; and, (3) maintaining close liaison with other Services to ensure thst all survivability R&D data and systems criteria are made available to the developers of aircraft. FY 1984 accomplishments include: characterization of the 30mm High Explosive Incendiary (HEI) fuse; determination that existing HALON 1301 engine extinguishing systems have combat damage protection; completion of Grill Heat, and Have Cedar tests; initiation of High Energy Laser (HEL) threat model coding; completion of Ground test of two On-Board Inert Gas Generating System (OBIGGS) concepts; development and incorporation of eight electronic countermeasure concepts into the Surface-to-Air Missile (SAM) model; validation of SA 7/9, -5, -2/3, -12/14, and -11 missile simulation algorithums with required updates initiated. Principsl goals in FY 1985 are to: determine the extent of battle damage existing engines compartment HALON 1301 extinguishing systems can accommodate; complete the validstion of the Surface to-Air-Missile (SAM) model; complete development of the High Energy Laser (HEL) threat model; and complete development of the electrooptical countermeasures effectiveness simulation model. In addition, the project will continue develop- of advance engine signature reduction technology; continue to update, document and disseminate a standard Enhanced Surface-to-Air Missile model (ESAM); continue to update and maintain a performance characterization and physical data matrix for foreign high explosive projectiles and warheads; investigate the feasibility of developing an On-Board Inert Gas Generating System (OBIGGS) for use in highly maneuverable, high speed tactical aircraft; and initiste development of more bsllistically tolerant composite compression structures. In FY 1986 the following major activities are

planned: continue development of advanced engine signature reduction technology; complete the evaluation of OBIGGS suitability to highly maneuverable, high speed tactical aircraft; Continue development of more survivable composite compression structure; develop, through test of aircraft components, probability of kill data for use in advanced survivability analysis; begin design and fabrication of a proof of principle multiplex Electronic Countermeasure/Radar antenna; begin development of a simulation model to evaluate the effectiveness of electro-optical countermeasure systems in support of test planning, expanded systems evaluation and reduced test cost; and initiate enhancement of the Surface-to-Air Missile model (SAM) to add infrared (IR) jamming, improved IR sensor logic, stand-off jamming effectiveness and an SA-13 missile simulation module.

B. (U) Project: 2899, Aircraft Battle Damage Repair (ABDR) Advanced Development Program. In an intense combat environment a significant number of aircraft will return with battle damage that will preclude their use until repaired. It will be essential that repairs be made and the aircraft returned to operational use as soon as possible if they are to contribute to the outcome of the combat situation. The purpose of this project is to provide enhanced and proven techniques, procedures, and design standards to rapidly assess and defer/repair battle damaged aircraft in an intense combat environment. The project extends the existing aircraft battle damage repair capability to be able to rapidly assess and repair advanced structures, flight control systems, and other flight critical aspects of current aircraft (F-15, F-16, A-10, etc.). The project also provides design guides and standards, and a resource qualification methodology that can be applied to advanced aircraft such as the advanced tactical fighter to increase battle damage tolerance, repair deferability, ease of assessment and repair, and validly quantify ABDR resources. This effort includes the collection, storage, dissemination and analysis of data to support the project and identify opportunities for technology application. In FY 1984 completed development of the combat damage repair estimating procedure and established repair time data basis for the A-7, F-4, C-130, B-1, F-111, HH 60, F-15, F-16, and AV-8B aircraft; verified existing transparency ABDR techniques on F-111 canopies; and initiated development of a standardized method to collect ABDR data necessary to support the USAF ABDR program. Principal goals in FY 1985 are: to identify and evaluate rapid repair techniques for engines; develop a static explosive device to simulate battle damage for use in ABDR training; and begin development of a prototype damage assessment diagnostic aid for flight control systems, a computerized ABDR assessors aid, a resource quantification methodology which defines, quantifies and predicts dynamic wartime ABDR parameters and their interrelationships to resource requirements, maintenance capability, and aircraft availability, and phase one of an effort to develop rapid repair techniques for structure and mission critical subsystems, and investigate system concepts and component designs, which allow repairs to be deferred. In addition, the ABDR data base will be maintained and expanded to include Israeli ABDR data. Major efforts planned in FY 1986 are as follows: demonstrate the prototype damage assessment system for flight controls; Complete fabrication of the Assessors Aid; test and validate the resource quantification methodology; develop rapid nonstandard repair techniques and investigate damage tolerant system/component designs; and continue to collect and analyze ABDR data from the Israelis and USAF exercises.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63245F
DOD Mission Area: #553 - Engineering Technology (ETD)

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	11,664	18,954	22,276	26,026	Continuing	N/A
2061	Fighter Attack Technology (AFTI/F-16)	4,200	2,300	2,153	9,399	Continuing	N/A
2568	Mission Adaptive Wing (AFTI/F-111)	2,700	1,000	391	490	Continuing	N/A
2682	STOL Maneuver Technology Demonstrator (STOL/MTD)	4,664	14,654	19,243	13,592	Continuing	N/A
2979	Reliability and Maintainability for Fighter Technology Integration	100	1,000	489	2,545	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop and demonstrate in flight, separately and in combination, advanced aeronautical technologies that can substantially enhance the combat potential, survivability, reliability and maintainability, of our future military fighter/attack aircraft. The Digital Flight Control System (DFCS) and Automated Maneuvering Attack System (AMAS) technologies developed under PE 63205F, Flight Vehicle Technology, will be integrated and flight demonstrated on the F-16 testbed under project 2061 of this program element. Testing several technologies on the same test vehicle reduces costs and facilitates the integration of these technologies. Project 2568 will develop and demonstrate in flight the smooth skin variable camber Mission Adaptive Wing (MAW) concept on an F-111 test vehicle. In conjunction with PE 63205F, project 2632 will develop Short Takeoff and Landing (STOL) technology options for future/derivative fighters to operate from bomb damaged/repaired runways while enhancing combat/cruise performance. The selection of candidate technologies for integration is carefully weighed in each case to provide mission relevance and maximum benefit for the testbed demonstration aircraft. Project 2979, in conjunction with project 2978 under PE 63205F will flight demonstrate the technical feasibility of an integrated control concept for reconfiguration, automated diagnostics and pilot alert of flight control systems malfunctions. This project will follow and coordinate the system improvement in reliability and maintainability. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	12,039	18,954	22,766	N/A	Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands): Not applicable.

5. (U) RELATED ACTIVITIES: This program is using the Advanced Fighter Technology Integration (AFTI) F-16 test vehicle to test the Digital Flight Control System and Automated Maneuvering Attack System technologies developed under PE 63205F, Flight Vehicle Technology. This program will also flight validate the integrated flight/propulsion control system and pilot/vehicle interface for Short Takeoff and Landing (STOL) mode operation being developed under PE 63205F, and engine control and development work in PE 62201F. The AFTI program develops and validates technology items on a demonstrator aircraft which will then be available for incorporation in the design of the Advanced Tactical Fighter (PE 63230F). The AFTI program is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. The Digital Flight Control System development in project 2061 is jointly funded by the Air Force and Navy.

6. (U) WORK PERFORMED BY: This program is managed by the Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. Contractors are General Dynamics Corporation, Ft. Worth, TX for project 2061; and The Boeing Company, Seattle, WA. for project 2568. Flight testing for both projects will be performed jointly by Dryden Flight Research Facility and the Air Force Flight Test Center at Edwards Air Force Base, CA., Project 2682 contract was awarded to McDonnell-Douglas Aircraft Corp of St. Louis, MO. in Oct 1984. Project 2979, has multiple contracts given to all seven main airframers in about equal amounts.

7. (U) PROJECTS LESS THEN $10 MILLION IN FY 1986:

A. (U) Project: 2061, Fighter Attack Technology (AFTI/F-16). This project develops and demonstrates in flight new aeronautical technologies offering improvements in combat effectiveness and survivability over current fighter aircraft. The program demonstrates these technologies, both separately and in combination, on the Advanced Fighter Technology Integration (AFTI) F-16/F-15 test vehicle. Technologies already demonstrated under this project during FY 1983 include direct side force control, direct lift control and weapon line pointing using a Digital Flight Control System integrated with a forward canard. This system gives the aircraft independent six degree-of-freedom control capability for increased maneuverability. The Digital Flight Control System also allows selection of task-tailored flight control laws providing optimized aircraft performance for air-to-air combat, bombing, and evasive maneuver. Advanced pilot/vehicle interfaces including improved displays were included in this recently completed Phase I flight testing. Integration and flight validation of the Automated Maneuvering Attack system began in FY 1984. The

Automated Maneuvering Attack System (AMAS) links the fire control system to the flight control system of the aircraft. AMAS will enable the aircraft to strike a target without direct overflight and will increase the firing opportunity envelope in air-to-air combat. AMAS will show a large improvement in survivability against all threats while maintaining delivery accuracies. The completion of the AMAS will be the first step in providing the Air Force with a single seat night under weather attack capability it needs in the 1990's and beyond. The following activities of terrain following/terrain avoidance/threat avoidance (TF/TA^2) and Integration of Control Avionics for Air Superiority (ICAAS) will be developed to complete the technologies needed for the night-under-weather capability. The FY 1984 Accomplishments were fabrication of the AMAS hardware. Phase II began Jul 1984, and adds Integrated Flight/ Fire Control capability including a Forward Looking Infrared (FLIR)/laser sensor tracker and a helmet mounted sight to the test vehicle. The AMAS phase will also include demonstration of the Standard Avionics Integrated Fuze (SAIF) concept for expanding the weapon release envelope of wide area munitions. The FY 1985 Program will evaluate total AFTI/ F-16 advanced technology system performance by firing live gunnery rounds and delivering inert bombs on AF test ranges. Preliminary investigation of advanced weapon delivery tactics including automatic weapon fuzing, direct force control, and weapon line pointing will follow initial technology demonstrations. The FY 1986 Planned Program completes development of Advanced Maneuvering Attack System integration including man-in-loop simulation for AFTI-16. Funding augmentation will be required to complete ground testing of the system on-board the aircraft and complete the flight test program. For ICAAS, work on the preliminary design criteria, which integrates the system onboard the F-15 test aircraft will be initiated. The system includes fire control, flight control, sensor suite, and advanced cockpit. In the outyears this continuing program will demonstrate: (1) TF/TA^2 - The pilot vehicle interface and associated software algorithms will be integrate and flight tested. The software will be hosted on the AFTI/F-16 Digital Terrain Base Display Generator. The APG-68 Fire Control Radar being provided by the F-16 SPO will be the primary sensor. The flight test will validate the state-of-the-art algorithms for TF/TA^2 under both day and night conditions; (2) ICAAS: - Integrate the system on-board the F-15 test aircraft, conduct the necessary ground checkouts, and complete the flight test program. Design criteria specifications will be developed, based upon well integrated ground simulation and flight test program, for application to ATF and derivative fighters; (3) Strategic Boost Glide Vehicle (BGV) will start the development of efficient hypersonic endoatmospheric (vs transatmospheric) aerodynamics on a 4 ft X 10 ft rocket launched glider.

B. (U) Project 2568, Mission Adaptive Wing (AFTI/F-111): This project is developing a smooth skin variable camber wing system and flight testing the system on an F-111 test aircraft. The wing box on the transonic aircraft technology F-111 test vehicle has been fitted with the variable camber leading and trailing edge wing system. The wing camber may be tailored in flight to achieve peak aerodynamic efficiency for a variety of missions. The development will increase aircraft range and maneuverability and is applicable to fighters, fighter bombers, strategic bombers and airlift aircraft. Initial flight testing will evaluate characteristics of a manual variable camber control system. An automatic flight control system to vary camber as a function of flight condition is being developed and will be evaluated after the manual system trials. Flight test will begin in FY 1985 and will demonstrate the full potential of the Mission Adaptive Wing for providing a 25 percent increase in range/fuel economy, a 10 percent expanded flight envelope, 20 percent enhancement in maneuverability (tighter turns and direct lift capability), and gust alleviation when compared to

the baseline F-111B. The FY 1984 Accomplishments included the fabrication of the Mission Adaptive Wing (MAW). The wing was shipped to NASA/Dryden. Installation on the F-111 was completed in Aug 1984. First flight of the manually operated MAW is scheduled for FY 1985. Fabrication of the automatic flight control system was completed in FY 1984. The FY 1985 Program is the flight validation of the MAW manual system. FY 1986 Planned Program: Complete flight test demonstration of the AFTI/F-111 (MAW) manual flight control system to include envelope expansion and begin flight test demonstration of the automatic flight control system. Continue data analysis.

C. (U) Project: 2979, Reliability and Maintainability (R&M) for Fighter Technology Integrated Systems: Integrates ground tests, and flight demonstrates enhanced reliability and maintainability concepts for advanced digital flight control system application developed by project 2978 in PE 63205F. By taking advantage of on-board computational power, significant improvement of the AFTI/F-16 integrity management system can be developed that handles a broader range of system failures. The program integrates fault tolerance and automated diagnostic functions providing enhanced fault detection and isolation. Maturing these fault tolerant and automated diagnostics techniques will allow dynamic reconfiguration of system resources, increasing the time between failures that impact the total system performance of the AFTI digital flight control system and the STOL engine controller. The project will then test the system in a ground based, realtime evaluation environment. Simulated malfunctions will be induced, testing the system's ability to identify, isolate faults, and take appropriate corrective actions. The effort's output will be the flight test baseline system. Flight testing will demonstrate the enhanced reliability and fault tolerance features for transition to operational use. This effort's output will be a validated set of design guides and criteria for future aircraft. In FY 1984 integration of ring laser gyro guidance set began. Ground testing of reconfigurable flight control concepts for the next phase began and the capabilities to do automatic diagnosis of some components of the flight control system was successfully demonstrated on a small portable computer. In FY 1985 the final design of the reconfigurable flight control system will be established. Once demonstrated, the self-repairing flight control system (SFCS) will be a significant force multiplier. In peacetime, it will ease diagnostics and reduce maintainance requirements. In war it will increase sortie rates by 50 percent through reduced battle damage repair requirements and improved survivability (up to a factor of two). The FY 1986 Planned Program will develop the detailed design of the control reconfiguration strategy and pilot alerting system for test in the high performance aircraft and develop the Class II modification design for the aircraft. It completes the test and evaluation of using the control mixer reconfiguration strategy to stabilize and control a small unmanned research vehicle when subjected to control surface failure or loss. It will flight test a modified version of the Multi-function Flight Control Reference System (MFCRS) with increased flight control damping. In FY 1987 and out-years this continuing program will: (1) incorporate the control reconfiguration strategy and pilot alerting system in the high performance aircraft; (2) conduct ground tests; (3) flight test the control reconfiguration strategy in the presence of simulated surface failures; (4) assess the positive information feedback to the pilot to the affect of the failures and reconfiguration; and (5) flight test an improved version of the MFCRS capable of MIL SPEC compliance with level one handling qualities across the full F-15 flight regime.

8. (U) PROJECT WITH OVER $10 MILLION IN FY 1986:

(U) Project: 2682, Short Takeoff and Landing Maneuver Technology Demonstrator (STOL/MTD).

A. (U) Project Description: This program is designed to provide STOL/MTD capability in time for all advanced supersonic fighters and ATF. Both the ATF statement of need and the scientific advisory board have validated this requirement for reduced landing and takeoff distances. This project will validate technologies to provide future tactical fighters a Short Takeoff and Landing (STOL) capability while maintaining or improving today's performance capability. Specific technologies to be addressed are: two dimensional thrust vectoring/reversing nozzle, integrated flight/propulsion coupling; advanced high lift system, rough/soft field landing gear,and cockpit displays and controllers for night/weather STOL operations. These technologies will provide synergestic benefits in takeoff and landing capability, cruise/range performance (acceleration, deceleration, turn rate, pointing, tracking) without a prohibitive weight or reliability and maintainability penalty. The successful development of this STOL capability will provide a solution to the runway interdiction problems facing our forces in Europe, as well as enabling our fighter aircraft to operate from less developed sites throughout the world.

B. Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Completed program planning documents including Sources Sought Synopsis, Business Strategy Panel, Source Selection Authority, Acquisition Plan, Contract Strategy Paper and Draft Request for Proposal (RFP). Reviewed industry comments on the draft RFP. Conducted STOL/MTD sources sought, selection and awarded contract to McDonnell Douglas Co, St. Louis, MO. Engine subcontract has been given to Pratt & Whitney.

(2) (U) FY 1985 Program: Long lead engine and airframe components will be put on order. The preliminary design will be completed and a design review conducted. Extensive wind tunnel testing will verify analytical models. Early in the year the second batch of long lead items for the engine will be ordered. The selected aircraft will be delivered and a structural review will be conducted.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 will see the completion of the critical design review and initiation of the final design. The testbed aircraft will be stripped in preparation for modification and raw materials for the modification will be delivered.

(4) (U) Program to Completion: This is a continuing program; however, current projects will complete design, fabrication, modification, integration, ground and flight test of STOL/MTD. Flight test will complete in the fourth quarter of FY 1989.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Complete Engine Nozzle Design Review	March 1986
(2) (U) Complete Aircraft Design Review	August 1986
(3) (U) Complete Aircraft Modification	August 1987
(4) (U) Complete Component Checkout	August 198[illegible]
(5) (U) Nozzle Certification	September 1987
(6) (U) Complete Ground Checks	March 1988
(7) (U) First Flight	April 1988
(8) (U) Flight Test	April 1988-September 1989
(9) (U) Final Report/Program Complete	April 1990

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 63250F — Title: Lincoln Laboratory
DoD Mission Area: #551 - Electronic & Physical Sciences (ATD) — Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	23,950	20,750	26,363	26,524	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Lincoln Laboratory program is a high technology research and development effort conducted through the provisions of a cost reimbursement contract with Massachusetts Institute of Technology. Lincoln Laboratory is operated as a Federal Contract Research Center with manpower control administered by the Department of Defense. The fundamental objective is to maintain a stable technology base in advanced electronics from which military systems may be developed. Utilizing this advanced electronics base, Lincoln Laboratory actively engages in advanced research, primarily in the area of satellite communications, tactical technology, space surveillance and radar techniques. Lincoln Laboratory also provides technical advice and consultation to the military services and defense agencies.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	23,950	23,700	26,943		Continuing	N/A

- In FY 1985, Congress cut $2.95M from program.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Military Construction	0	[illegible],200	0	0	0	N/A

5. (U) RELATED ACTIVITIES: Lincoln Laboratory technical staff members support the following respective programs: Milstar, PE 33603F; Advanced Space Communications, PE 63431F; Command, Control, and Communications, PE 62702F; SPACETRACK PE 12424F; Space Surveillance Technology, PE 63428F; Communications Security, PE 33401F; and Defense Research Sciences, PE 61102F.

6. (U) WORK PERFORMED BY: Lincoln Laboratory, Lexington, MA, is operated as a special laboratory of the Massachusetts Institute of Technology under contract with the Air Force and is designated a Federal Contract Research Center. General policy and program guidance is provided by the Joint Advisory Committee in accordance with the provisions of the Department of Defense Plan for Administration of Lincoln Laboratory, dated 27 May 1975. The Lincoln Laboratory contract is administered by the Air Force System Command's Electronic Systems Division.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable.

PE#: 63250F

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63250F, Lincoln Laboratory

A. (U) Project Description: Lincoln Laboratory was established in 1951 by the Air Force with participation by other agencies of the Department of Defense. The primary mission is to conduct research and development pertinent to national defense, with particular emphasis on advanced electronics. The Lincoln program extends from fundamental investigations in science through the development of electronic devices and components to the design, development, and field demonstration of conceptual models containing the new technology. Lincoln actively engages in advanced research primarily in the areas of satellite communications, tactical technology, space object surveillance and identification, and radar techniques. Lincoln also provides technical advice and consultation to the military services and defense agencies.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Development of Extremely High Frequency (EHF) satellite communications system technology continued, particularly efforts to transfer this technology to Milstar contractors to reduce the cost and risk in the acquisition of the Milstar system. Restructurable Very Large Scale Integration (RVLSI), one of the techniques essential to implementing wafer-scale integrated circuits, was investigated. Emphasis on sub-micron electrons and its application in signal processing and communications continued. Tactical sensor technology programs continued. A laboratory demonstration of a heterodyne laser communications system was defined to test its applicability for future satellite-to-satellite crosslinks. A laboratory demonstration of space-based radar technology components was made to verify a concept for background clutter rejection.

(2) (U) FY 1985 Program: The advanced electronics, satellite communications, tactical technology, and space surveillance areas will be continued. The advanced electronics area will continue to push the state-of-the-art in solid state and digital integrated circuits. The satellite communications effort will continue to advance the technology which will exploit the capabilities of satellite communications systems, particularly Extremely High Frequency (EHF) systems, for military users. The tactical technology effort will emphasize the surveillance, strike, and communications areas. Technology applications for deep space surveillance will be continued. Approximately 130 research man-years are supported by the FY 1985 planned program.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The basic thrusts in advanced electronic satellite communications, tactical technology and space surveillance will be continued. Key advances in wafer-scale integration and laser communications are anticipated during this time period. New technology identified that has the potential to satisfy military requirement will be pursued. Approximately 130-140 research man-years will be supported annually by the FY 1986-90 planned program.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element #63253F — Title: Advanced System Integration Demonstrations (ASID)
DoD Mission Area: #551 - Electronics and Physical Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		22,903	30,000	35,327	26,382	Continuing	N/A
2538	Integrated Communication-Navigation-Identification Avionics (ICNIA)	13,223	17,600	16,107	5,900	Continuing	N/A
2734	Advanced System Avionics (ASA)	8,180	8,200	4,220	5,382	Continuing	N/A
2735	Integrated Flight Demonstrator (IFD)	1,500	1,200	800	800	Continuing	N/A
3003	Standard Modular Avionics System Architecture (SMASA)	0	3,000	8,000	10,000	Continuing	N/A
3062	PAVE SPRINTER	0	0	7,200	4,300	23,600	35,100

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current avionics systems represent a substantial and increasing fraction of aircraft acquisition and support costs. The ASID program will exploit a number of recent innovations in systems architecture, semiconductor technology, and computer standardization and software to integrate and automate avionics functions for advanced aircraft. Objectives include operational performance improvements, very high mission reliability, fault tolerance, substantial reductions in both acquisition and support costs, and reduction of crew workload in dense threat environments. To satisfy these specific objectives, major thrusts are currently underway for early insertion of Very High Speed Integrated Circuits (VHSIC) processors in both core avionics and selected subsystems. A key effort will be the Pave Sprinter Demonstration which integrates an ICNIA and selected other VHSIC modular avionics subsystems into the F-15, F-16 and possibly the F-111 aircraft. Additionally, an intense effort will be pursued to develop standard modular packaging techniques and to flight-test advanced development hardware on tactical aircraft. These efforts, if successful, will greatly reduce size and weight, increase reliability, and substantially lower overall operations and support costs.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	23,523	33,155	21,127		Continuing	N/A

In FY 1984, $600 was reprogrammed into PE 27130F, F-15 Squadrons, to conduct a feasibility study to determine the applicability of ASA architecture to F-15 avionics. In FY 1985 the Congress, while approving the Pave Sprinter project as a new start, provided only $3,000,000 of the requested project funds of $6,000,000. In FY 1986 $15,200,000 was added to the FY 1985 projection to accomplish the Pave Sprinter project, which is funded from two different projects to allow separate identification of OSD Reliability and Maintainability funds (Project 3003) and complementary Air Force funds (Project 3062).

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: PE 62204F, Project 2003, Avionics System Design Technology; PE 63203F, Project 2733, Advanced Reconnaissance/Strike Radars; PE 63718F, Project 2432, Integrated Electronic Warfare System (INEWS); PE 62204F, Project 6095, Inertial Reference and Guidance; and PE 62204F, Project 7662, Avionics Data Transmission and Reception will provide supporting technology for this Program. PE 63226F, DoD Common Programming Language (Ada) Advanced Development and PE 63728F, Advanced Computer Technology will provide Ada support software products for use by this program for application to avionics related software developments. Close coordination between this program and PE 63601F, Project 670A, Ordnance Technology, will be maintained to assure successful implementation of MIL-STD-1760, Aircraft-to-Stores Interface. Close coordination with PE 63231F, Project 2829, Cockpit Automation Technology, will be maintained to assure appropriate use of new automation, control and display concepts. Several items of work being accomplished under PE 62204F, Project 2003, have been partially funded by Advanced System Avionics (ASA) and have been transitioned into the ASA baseline. These efforts are: Airborne Electronic Terrain Map System, a Multi-bus Avionics Architecture Design Study, and a Video Information Distribution System Study. The ASA program will use hardware developed under PE 63452F, Project 2700, Very High Speed Integrated Circuits (VHSIC) as well as VHSIC insertion funding in developing the VHSIC 1750A processor and the VHSIC Common Signal Processor (CSP) required in the ASA baseline.

6. (U) WORK PERFORMED BY: Current efforts are being performed by Rockwell International, Collins Avionics Division, Cedar Rapids, IA; International Telephone and Telegraph Avionics Division, Nutley, NJ; McDonnell Douglas Corporation, St Louis, MO; Northrop Corporation, Hawthorne, CA; and TRW Incorporated, San Diego, CA. The in-house organization responsible for the program is the System Avionics Division, Avionics Laboratory, Wright-Patterson Air Force Base, OH. The Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH and the Air Force Human Resource Laboratory, Brooks Air Force Base, TX are two in-house organizations supporting this program.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2734, Advanced System Avionics (ASA) - The Air Force is presently faced with significantly increasing development, operational, maintenance and support problems as a result of requirements for the expanded use of avionics to achieve multimission capabilities for aircraft. Proliferation of hardware and software, coupled with parallel growth of support equipment, maintenance, spares, etc, are incurring costs that are becoming unaffordable. The ASA project will design, develop, simulate and test new technologies and advanced concepts in avionics system integration to obtain operational improvements, very high mission reliability and fault tolerance while reducing both acquisition and support costs. These improvements will be pursued with the dual goal of equipping new aircraft while allowing affordable retrofits to upgrade existing aircraft. The resultant advanced avionics system developed by Project 2734 will be integrated in a ground simulation facility to thoroughly test the proposed technologies and concepts. The major technologies/concepts to be demonstrated include Very High Speed Integrated Circuits (VHSIC) processors, high-speed data busses, fault tolerant architectures, the Ada programming language, optimal on-equipment maintenance concepts, information coupling techniques, modular packaging, and crew station automation. Preliminary estimates show the potential benefits from ASA to be: (1) at least a 50% increase in probability of aircraft survival in a

dense threat environment; (2) a five fold increase in avionics system mean-time-between-failure; (3) halving mean-time-to-repair; (4) significant aircrew workload reduction; and (5) an almost 50% reduction in support costs. In FY 1984 five contractors completed candidate system architecture definition studies, the results of which are being used to specify candidate development systems for the Advanced Tactical Fighter (ATF). Multiple award contracts will commence in FY 1985 and continue through FY 1986 to develop at least two advanced system avionics architecture candidates for Ground Based Laboratory (GBL) demonstrations and possible flight testing during ATF development. In addition to this effort, work will continue on the development of a high speed data bus, a video data bus, and sensor fusion algorithms. Another planned effort will provide a modular design approach for the ASA core components (signal processor, power supply, etc.). These families of common modules will be evaluated to determine their contribution to improved reliability and maintainability and their potential to reduce required support equipment and spares.

B. (U) Project: 2735, Integrated Flight Demonstrations - This project will provide test requirements, plans and flight validation of the technology and system implementations developed/integrated under Projects 2734, Advanced System Avionics (ASA); 2538, Integrated Communications-Navigation-Identification Avionics (ICNIA); and 3003, Standard Modular Avionics System Architecture (SMASA). A test aircraft will be configured to provide a low cost flight environment to not only flight test evolving avionics but also to provide a flexible testbed to support testing of other developmental equipment. FY 1984 funds were expended to: (1) define ASA flight test requirements; (2) perform initial flight testing of the Sandia Inertial Terrain-Aided Navigator (SITAN) algorithm; and (3) develop sensor fusion algorithms to provide a low altitude penetration capability. ASA flight test planning started in FY 1985 following completion of the definition contracts in FY 1984. SITAN and sensor fusion algorithm flight tests will continue with completion in FY 1986. ICNIA flight tests will start in 1987 and continue through 1989.

C. (U) Project: 3003, Standard Modular Avionics System Architecture - The project will develop the engineering and test specifications and initiate standardization activities for a family of standard common avionics modules defined during the ASA system architecture studies. To prove the standard common modular avionics concept, funds from this project will also be used to build and flight test selected avionics subsystems such as modular ICNIA, a modular inertial navigation system and other modular subsystems as deemed appropriate. This modular concept will also be implemented in the Ultra Reliable Radar (URR), Integrated Electronic Warfare System (INEWS) and Infrared Search and Track System (IRSTS). The emphasis will be on packaging in a common module physical configuration (Navy "Format C" or modified Format C) to meet the requirements above. The modular construction will be compatible with either future concepts, such as the integrated rack or with standard enclosures (3/4 Air Transport Racks (ATRs) and 6 Modular Computing Units (MCUs)) suitable for retrofit in existing aircraft. Analysis and research support will be provided through Flight Dynamics Laboratory (FDL), supplementing their integrated thermal analysis and design efforts, Air Force Human Resources Laboratory (AFHRL) (logistics impact and advanced logistics applications), ICNIA Advanced Development Model (ADM) contractors (additional reliability and maintainability (R&M) tradeoffs, and embedded diagnostics and testability enhancements) and competitive development of selected functions, in the modular physical form-fit configuration, which have potential generic configuration in core avionics, ICNIA and other sensor systems (embedded 1750, digital signal processing Central Processing Unit (CPU), standard bus Inputs/Outputs (I/Os), power supplies, etc.). Any common modules so developed will be subjected to preliminary qualification testing to demonstrate suitability. First priority for funding in FY 1985, FY 1986, and FY 1987 will be the modular ICNIA terminals.

D. (U) Project: 3062, Pave Sprinter - This project will flight demonstrate on an F-15, an F-16 and possibly an F-111 aircraft a limited physical implementation of the Standard Modular Avionics System Architecture (SMASA) developed in project 3003. SMASA will be a subset of the architecture specified by the Advanced System Avionics (ASA) definition contracts conducted in project 2734 and will be limited to concepts or techniques employing 1985 technology that are applicable to current generation aircraft. The primary thrust of the project is to show the benefits of Very High Speed Integrated Circuits (VHSIC) technology for avionics upgrades of these aircraft. In addition to proving the VHSIC-based modular architecture, Pave Sprinter will demonstrate optimal on-equipment maintenance capability with the intent of reducing the dependence upon expensive intermediate maintenance support equipment. A modular Integrated-Navigation-Identification Avionics (ICNIA) subsystem developed in project 2538, a fault tolerant inertial reference assembly (FTIRA) developed in project 666A, PE 63203F, and a fiber optics high speed data bus developed in project 2734 will be demonstrated on the F-16. Candidate subsystems for demonstration on the F-15 and the F-111 will be selected at the conclusion of the feasibility studies currently underway.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2538, Integrated Communication-Navigation-Identification Avionics (ICNIA)

A. (U) Project Description: The objective of the ICNIA Project is to develop, fabricate, test, and evaluate an advanced development model (ADM) version of an integrated Communication, Navigation, and Identification (CNI) avionics system. The project is critical to overcoming weight, size, cost, logistics, and maintenance problems brought about by the current utilization of unique, single function CNI systems. The current systems lack the flexible growth capability needed to meet future dynamic mission requirements, threat environments and increased pilot taskings. The ICNIA Project will seek to: (a) demonstrate a synergistic, integrated subsystem approach to avionics for all CNI function in the 2MHz to 2GHz spectrum; (b) test and evaluate the ADM on the Integrated Electromagnetic System Simulator (IESS), a system to be developed to simulate the CNI signal environment of a modern tactical aircraft operating in a hostile environment; and (c) develop a detailed set of specifications to be used as a basis for engineering development and production of ICNIA terminals. Further, VHSIC modular terminals will be designed, fabricated and flight tested on F-15, F-16 and possibly F-111 aircraft as part of the Pave Sprinter Demonstration (project 3062). Currently two competing technical approaches involving different levels of risk are being pursued under contracts to TRW and an ITT/Texas Instruments team. The ICNIA program is a joint Air Force-Army development effort with the U.S. Army providing $17,000,000 of the total contract price.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The IESS contract was awarded to TRW. TRW and ITT/TI continued detailed design and began fabrication of breadboard critical items. An independent analysis of the ICNIA ADM software started late in the fiscal year.

(2) (U) FY 1985 Program: TRW and ITT/TI are continuing development of their respective ICNIA terminals and, after the Critical Design Reviews in June and July 1985, a decision will be made to either continue with both contractor approaches or to down-select to a single contractor. Design of the modular ICNIA terminals for Pave Sprinter will be started. Fabrication of the IESS facility will be initiated.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 funds of $13,427,000 are requested to fund completion of the two ICNIA ADM breadboards and the start of fabrication of brassboard and ADM ICNIA terminals by either one or both contractors. FY 1986 funds of $7,000,000 from project 3003 and $3,000,000 from PE 63452F, Very High Speed Integrated Circuits (VHSIC), are also being requested to complete design and start fabrication of VHSIC modular ICNIA terminals for F-15, F-16 and possibly F-111 testing. Actions that must be accomplished prior to initiating full scale engineering development of ICNIA retrofit kits will be started in FY 1986. Costs are Category III and are based on negotiated contracts and government experience on similar advanced development programs. The IESS system design and fabrication will be continued.

(4) (U) Program to Completion: Either one or two ICNIA ADM terminal types and a similar number of VHSIC modular terminals will be fabricated, evaluated and flight tested. They will be evaluated using the IESS and flight tested by the Army and the Air Force. Full scale engineering development of ICNIA retrofit kits for F-15, F-16, and possibly F-111 aircraft will be intiated and transitioned to PE 64219F in FY 1987 or FY 1988 as deemed appropriate by FY 1986 efforts. The IESS will be fabricated and integrated with ICNIA for evaluation of the ICNIA.

C. (U) Major Milestones:

	Milestones	Dates
(1)	TRW Critical Design Review	June 1985
(2)	ITT/TI Critical Design Review	July 1985
(3)	Delivery of Ground Test Model	September 1987
(4)	Delivery of U.S. Army Model	December 1987
(5)	Delivery of Air Force Flight Test Model	March 1988
(6)	Delivery of Electronmagnetic System Simulator	June 1988
(7)	Complete Flight Testing	December 1989

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63259F Title: Cartographic Applications for Tactical and Strategic Systems
DOD Mission Area: #551 - Electronics and Physical Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	1,094	1,409	1,732	Continuing	N/A
2810	Digital Mapping, Charting and Geodesy Technology	0	1,094	1,409	1,732		

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Cartographic Applications for Tactical and Strategic Systems (CATSS) program directly supports Air Force users and developers of those rapidly growing numbers of systems whose mission performance is dependent upon or can be enhanced by the use of digital cartographic data. The Defense Mapping Agency (DMA) cannot keep pace with the production demands imposed by these Air Force systems and is falling behind in providing these critical data bases. This is severely impacting the Air Force. Other efforts are underway to help DMA increase its production yield. However, much can be done in the Air Force to help ourselves by providing "smart tools" to developers of Air Force weapon systems needing this specialized data. Already existing data can be reused, common data requirements and new techniques can be investigated in manipulating and optimizing these data bases in the weapon system design phase (United States Air Force Intelligence Statement of Need 003-81 "Digital Cartographic Applications Program"). This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E				2,440		7,896	11,430

The change in the FY 1986 funding reflects current priorities. The initially, planned program is still programmed at $11.4 Million through FY 1991; however with the continuing need for digital cartographic data, this program must continue to maintain the Air Force requirements via a single specification and the applications software tools necessary to adapt standard DMA products to operational software within weapons systems.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: Supporting exploratory development activities have been conducted in PE 62702F, Command, Control and Communications (C^3), with two preliminary definition efforts initiated in FY 1982 and FY 1983. These efforts are completed. They identify and technically consolidate all Air Force projected digital cartographic data requirements. The results of these efforts, one for strategic needs, one for tactical needs, will be the basis for the development of the Air Force consolidated requirements specification in this program. Other related work is ongoing in PE 63701B, Defense Mapping Agency (DMA) Advanced Development, and PE 64701B, DMA Engineering Development. The development efforts under these two programs are performed by the Services for DMA. The Air Force portion is performed at Rome Air Development Center (RADC) while the Army and the Navy also have developments using digital cartographic data. The Air Force is by far the biggest user of DMA produced data (70 percent) and inclusion of the other services' needs in the initial program would introduce unacceptable technical risk. Other services' development will be included in this program where practical and all services will be able to use the developed tools.

6. (U) WORK PERFORMED BY: In-house efforts and contract monitoring will be done at Rome Air Development Center, Griffiss AFB, NY.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2810, Digital Mapping, Charting and Geodesy Technology

A. (U) Project Description: The Cartographic Applications for Tactical and Strategic Systems (CATSS) program will develop data base structures which support multiple Air Force systems requirements, develop applications algorithms to more efficiently manipulate/transform/exploit the data and develop techniques to assist users/developers to more accurately define their requirements. There will be two outputs. The first will be a single Air Force specification for its future digital cartographic data base needs. This will, by reducing the proliferation of system-unique data base requirements, shift significant portions of the DMA cartographic data production resources into expanding the terrain coverage and away from the costly reformatting of existing data. For the Air Force, this will enhance the operational effectiveness and flexibility of new systems being fielded, such as cruise missiles and the joint surveillance and target attack radar system. The second product will be a set of computer software support tools for digital cartographic data. Their delivery to weapon systems developers will eliminate the wasteful practice of paying for duplicative contractor efforts on different programs to address common functional applications. Additionally, it will allow developers to improve and verify their systems designs by using the actual Air Force data base elements during their experimental design phase. A conservative estimate of potential savings is 25 million dollars annually.

B. (U) Project Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable.

(2) (U) FY 1985 Program: The Cartographic Applications for Tactical and Strategic Systems (CATSS) design will begin in FY 1985 with a one year CATSS functional applications design effort. This effort will include design of software and data base structures to support Air Force generic functional applications such as low level navigation, target identification, and weapons terminal homing. The CATSS design will also include the development of a sensitivity model for evaluating the impact of changes to systems requirements. Three months after the CATSS design starts, detailed definition of the data base structure will begin. This will be followed in another six months by the start of a generic data base implementation and transformation and compaction computer software development. This development will produce algorithms to take the Defense Mapping Agency's generic data base output and transform it to the data structures needed for generic functional applications and will produce techniques to compact the data to meet the limited data storage capabilities of operational systems.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The generic data base definition and implementation, started in FY 1985, will be completed in FY 1986. The result of this effort will be an Air Force specification standardizing AF requirements for digital cartographic data. This specification will be an input to the Defense Mapping Agency's planned FY 1987 master data base update. The transformation and compaction software development will continue during FY 1986. The CATSS data base structural definition phase will be completed in FY 1986.

(4) (U) Program to Completion: This is a continuing program. Program is structured to enhance technology development, application, and transition of digital cartographic technology. Transformation and compaction software development will be completed in FY 1987. The detailed design implementation and demonstrations are scheduled to start in FY 1987 and conclude in FY 1990. Interactive refinements of the detailed applications designs with system developers and transition of the software support tools to them will begin in FY 1987.

C. (U) Major Milestones:

	Milestones	Dates
(1)	CATSS Functional Applications Design Begins	February 1985
(2)	Data Base Structure Definition Begins	April 1985
(3)	CATSS Functional Applications Design Complete	January 1986
(4)	Data Base Structure Definition Complete	July 1986
(5)	Detailed CATSS Design Implementation and Demonstrations Begin	October 1986
(6)	Transition of Techniques to System Developers Begins	April 1987
(7)	Detailed CATSS Design Implementation and Demonstrations Complete	December 1989
(8)	Transition of Techniques to System Developers Complete	June 1991

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63302F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Space and Missile Rocket Propulsion
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,273	2,000	8,331	17,843	Continuing	N/A
6339	Air-Launched Missile Prop	0	500	1,936	4,943		
6340	Space Systems Propulsion	1,273	1,500	4,505	9,700		
6341	Ballistic Missile Propulsion	0	0	1,940	3,200		

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops, integrates and demonstrates advanced rocket propulsion technology to provide for the proper transition of the technology to systems development and upgrades. This is the only Air Force program that provides this technology. These technologies provide increased performance to enable systems to meet expanding mission requirements. Because of the need for these systems to also be reliable, maintainable and affordable the advanced technology options must be fully demonstrated to ensure they are ready for transition. This program provides these demonstrated technologies for ballistic missile, air-launched missile and space propulsion systems. This is a Science and Technology Program. The efforts in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,273	5,547	12,302		Continuing	N/A

(U) The FY 1985 funding was reduced by Congress. No rationale was provided. This caused reductions to projects 6339 and 6340. The FY 1986 funding was adjusted during the DOD budget cycle to fund higher priority programs but also maintain critical technology demonstrations to meet Air Force systems requirements.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The technology demonstrated in this program is initially developed in an Exploratory Development Program 62302F, Rocket Propulsion. These two programs make up the entire Air Force investment in rocket propulsion science and technology. Coordination of this technology with other Department of Defense organizations is accomplished through the Joint Army-Navy-NASA-Air Force (JANNAF) Inter-agency Propulsion Committee. This committee is

made up of sub-committees that include working level representatives from these agencies. This program element provides demonstrated technology for potential use in the following program elements: 64312F, Peacekeeper/Small Intercontinental Ballistic Missile; 63401F, Advanced Spacecraft Technology; 64411F, Space Shuttle; 64314F, Advanced Medium Range Air-to-Air Missile.

6. (U) WORK PERFORMED BY: Management of this effort is provided by the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA. All work is done under contract. Rockwell International Rocketdyne Division, Canoga Park, CA (project 6340) and Hercules, Inc, Magna, UT, (project 6339) are currently the only contractors.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 6339, Air-Launched Missile Propulsion. This project demonstrates technology specifically for air-launched missile propulsion systems. The demonstrations are done in general representative size so one technology effort can be applicable to more than a single system. In FY 1984 an effort was started in 62302F that will transition to this program in FY 1985. It is the demonstration of an advanced air-launched missile motor that will have the capability of providing an additional 50 percent stand-off range over existing systems. This performance increase is achieved by the integration of demonstrated radial pulse motor technology with higher energy propellant and new lightweight composite motor case technology providing a very high performing missile system. The increased performance offered by this technology is applicable to the Advanced Air-to-Surface Missile (AASM) system. This effort will transition the technology to the Advanced Air-to-Surface Missile (AASM) program by FY 1986. A new effort to develop a high performance low observable air-launched missile motor will begin in FY 1986. This effort is planned to provide technology for weapons options for the Advanced Tactical Fighter and other tactical missile systems both air-to-air and air-to-surface. This will demonstrate technologies to allow for conformal carriage on an aircraft and a low signature during missile flight. Design studies will be accomplished and component fabrication will begin. One potential option for this technology would be as an upgrade to the current Advanced Medium Range Air-to-Air Missile (AMRAAM) through the pre-planned product improvement program.

B. (U) Project: 6340, Space Systems Propulsion. The purpose of this project is to demonstrate advanced propulsion technology for space systems. This includes launch vehicles, orbit transfer systems, and satellite propulsion systems. This area of technology has been growing in the past few years because of the Air Force's requirement for more routine use of space. The first task in this project is to continue the development and demonstration of a modular space propulsion system that can be used as a single module for evasive maneuvering to enhance satellite survivability against a growing anti-satellite threat. This same propulsion technology can be used by combining modules to provide a 140 percent payload growth capability (over the current Inertial Upper Stage (IUS) capability) when used as a spacecraft deployment vehicle operating out of the shuttle. The modular feature (the clustering of propellant tanks and engines) allows for the propulsion system to be embedded in a satellite or to operate as a separate stage. The versatility of the modular approach is unlimited and provides the Air Force with a great deal of mission flexibility while reducing development costs, since a new system development is not needed for each new satellite. In FY 1984 engine design trade studies were completed and breadboard subcomponents were fabricated. In FY 1985 these subcomponents

will complete testing and a breadboard engine will be assembled and undergo a full cycle of tests including sea level and altitude firings. In FY 1986 the modular space propulsion system will complete design trades and begin fabrication of the feed system subcomponents. The second task will start in FY 1986 and result in the demonstration of a compact cryogenic propellant feed system utilizing a toroidal liquid oxygen tank. The use of a toroidal liquid oxygen tank on an upper stage operating out of the space shuttle cargo bay can allow for payloads 40-42 feet in length and can provide a 38 percent increase in payload carrying capability over the shuttle/Centaur G stage. Fabrication of subscale toroidal tankage will begin to demonstrate and refine the fabrication techniques for the full scale tanks. Both of these tasks are based on requirements for satellite maneuvering and large payload orbit transfer vehicles.

C. (U) Project: 6341, Ballistic Missile Propulsion. This project demonstrates advanced technology concepts for future ballistic missile systems and modernizations. It provides propulsion advances to allow for increases in strategic force capability. This project will begin an effort in FY 1986 to develop both conventional and integrated stage concept technology for the future Advanced Intercontinental Ballistic Missile. This effort will begin with design and fabrication of component level hardware for both a very high performance conventional motor and an integrated stage motor.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63313F
DOD Mission Area: #221 - Counter Air

Title: Advanced Missile Subsystems Demonstration
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	1,209	6,195	22,287	29,691
2697	Airbreathing Missile Propulsion	0	0	1,209	6,195	22,287	29,691

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a new start for FY 1986. The mission need addressed by this program is air-to-air superiority against the future threat. Air superiority can be maintained if missile performance is improved in conjunction with advances in aircraft and fire control. The needed missile propulsion improvement can be provided by an airbreathing ramjet engine such as a variable fuel flow ducted rocket (VFDR) which uses a fuel-rich solid propellant gas generator as the fuel source and maintains the handling and storage characteristic of conventional rockets. This ramjet type of engine, with a solid fuel source, variable fuel flow control, advanced rocket booster, and maneuver tolerant inlet can significantly enhance the performance capability of air-to-air missiles. Specific goals are increased average missile velocity and launch ranges of up to three times that of conventional rocket motors. The engine technology provided by this development is intended to support full scale development of future tactical air launched missiles for Dual Role Fighter and Advanced Tactical Fighter armament along with other applications (air-to-surface, surface-to-air).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	0	1,234	1,232		24,850	27,316

Congress denied FY 1985 funding. This is an FY 1986 restart.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This advanced development program further develops and integrates components proven feasible in exploratory development under Program Element 62203F, Aerospace Propulsion. Booster technology builds upon that developed in Program Element 62302F, Rocket Propulsion. Efforts currently being pursued in exploratory development

include an advanced nozzleless booster, an advanced gas generator fuel with a variable fuel flow throttle valve, carriage technology, inlet/port covers, and advanced materials. This is the only solid fuel, variable flow ducted rocket ramjet missile advanced technology demonstration program within the Department of Defense.

6. (U) WORK PERFORMED BY: The planned effort will be managed by the Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio. Contractor will be selected by a competitive bid in FY 1986.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2697, Airbreathing Missile Propulsion

A. (U) Project Description: This project will develop and integrate the engine components (inlet, gas generator/valve, booster, ramburner) required to realize a variable fuel flow ducted rocket engine using a solid hydrocarbon fuel. Engine performance shall be extensively evaluated through a ground test program which includes environmental and freejet testing. The end product is a flightweight engine ready for flight test and/or full scale development.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable.

(2) (U) FY 1985 Accomplishments: Not applicable.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: This is a new start for FY 1986. Initiation of this program in FY 1986 will provide the Air Force with advanced missile propulsion capability in the 1990s to meet the expanding threat, such as a Soviet AIM-120 equivalent. Initial engine design and performance requirements will be established. Changes and/or improvements required in components previously investigated in exploratory development will be determined and initiated. Cost estimates are based on historical data for component and engine development and were reviewed in March 1984 (Confidence Level Category IV).

(4) (U) Program to Completion: The remaining program will complete development of all the required components, integrate these components into a complete flightweight engine, and complete performance verification in direct-connect and freejet ground tests. Environmental tests of the rocket booster and gas generator will be completed. The final freejet engine tests in September 1990 will demonstrate a flightweight engine ready for flight test and/or full scale development in a future program which would include the integration and demonstration of other missile subsystems.

C. (U) Major Milestones:

	Milestones		Dates
(1)	Contract Award		March 1986
(2)	Initial Design/Requirements	*(FY 1985)	September 1986
(3)	Component Integration	*(FY 1989)	May 1988
(4)	Booster Development		September 1988
(5)	Inlet Test	*(FY 1988)	October 1988
(6)	Performance Verification	*(FY 1991)	May 1989
(7)	Environmental Test	*(FY 1991)	June 1990
(8)	Freejet Test	*(FY 1992)	September 1990

* Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

Congressional denial of FY 1985 funds delayed program start. Completion of this demonstration in FY 1990 will permit the availability of ducted rocket propulsion technology for inclusion in Advanced Tactical Fighter (ATF) weapons. Aeronautical Systems Division/Air Force Wright Aeronautical Laboratories have identified the variable fuel flow ducted rocket as a critical technology for ATF. Later completion would prohibit ATF ducted rocket use, as the technology availability date would be missed.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63319F
DOD Mission Area: #553 - Engineering Technology

Title: Advanced Technology Cruise Missile
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		14,768	15,417	7,677	8,782	Continuing	N/A
2877	Cruise Missile Advanced Guidance	14,768	15,417	7,677	8,782	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Cruise Missile Technology program develops improved propulsion systems, reduced observables (radar and infrared), enhanced avionics, and improved performance guidance and control systems for cruise missiles. The technology will lead to improvements to extend the viability of current cruise missiles and support development of future, more versatile strategic and tactical missile systems. The program will continue to exploit cost-effective technological opportunities which decrease missile vulnerability to enemy threats, improve effectiveness and reliability of weapon performance, and enable replacement of nuclear with non-nuclear warheads for appropriate missions. This program will help maintain the momentum of United States cruise missile development efforts and provide high confidence in technical options for development of advanced missile systems.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	17,672	15,417	10,845		Continuing	N/A

(U) Late contract award delayed the start of this program. As a result, the program schedule was slipped which reduced the funding required in FY 86.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Not Applicable.

5. (U) RELATED ACTIVITIES: Cruise Missile Advanced Guidance, Project 2877, consolidated Air Force activities to develop and demonstrate multi-function CO_2 laser guidance technology for long range cruise missiles. Project efforts consisting of dual awards for guidance concept development and several contracts for technical support and

weapon system interface definition, will use technology developed under: the Defense Advanced Research Projects Agency (DARPA) Autonomous Terminal Homing (ATH) Program, PE 62301E; the Air Force Armament Laboratory (AFATL) Backbreaker/Optionbreaker Program, PE 62602F/project 2068; and the Air Force Wright Aeronautical Laboratory CO_2 Laser Technology (COLT) Program proposed under PE 63601F. The Advanced Guidance System (AGS) effort of PE 63319F, Advanced Cruise Missile Technology will be continued. Project participation by Defense Mapping Agency will assure support of mission planning for the guidance concepts.

6. (U) WORK PERFORMED BY: The two prime contractors for the program are General Dynamics Convair Division, San Diego, California, and McDonnell Douglas Astronautics Company, St Louis, Missouri. Responsibility for this program is assigned to the Aeronautical Systems Division, Wright Aeronautical Laboratories, of the Air Force Systems Command at Wright Patterson Air Force Base, Ohio. Related efforts will be performed by Rome Air Development Center at Griffiss Air Force Base, New York, and Massachusetts Institute of Technology Lincoln Laboratory, Lexington, Massachusetts.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986

(U) Project: 2877, Cruise Missile Advanced Guidance

A. (U) Project Description: Navigation and guidance accuracies of current cruise missiles are adequate for attack of strategic targets using high-yield nuclear warheads. To provide non-nuclear warhead options for attack of a greater number and variety of high-value targets, greatly reduce premission preparation effort, and improve mission flexibility and missile survivability, additional development of highly accurate guidance concepts is required. The objective of this program is to develop and demonstrate multi-purpose CO_2 Laser Radar guidance technology for cruise missiles which must penetrate high threat environments at low altitudes in adverse weather. The guidance concepts developed under this program must demonstrate: 1) improved midcourse navigation to increase route flexibility and reduction of mission planning time and cost; 2) terrain following/obstacle avoidance to enable reduction in flight altitude and corresponding increase in missile survivability; 3) precision terminal homing to allow substitution of non-nuclear warheads, reduction of collateral damage in sensitive target areas, and destruction of hard strategic targets with smaller nuclear warheads; 4) autonomous strategic bomb damage assessment for post-strike reconnaissance or restrike of previously targeted but undamaged critical targets; and 5) mobile target identification/submunition aiming for attack of more than one target with each missile. The program will include design, fabrication, and captive flight test of two competing brassboard guidance systems into specific missile airframes.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Two advanced guidance systems were designed, and plans prepared for fabrication and captive flight test demonstration of the multiple guidance functions. Associate contractors were selected to provide technical support in the areas of mission planning, operational utility assessment, and missile integration.

(2) (U) FY 1985 Program: The development and demonstration of two competing multi-purpose advanced guidance systems will continue. Specifically, fabrication of the guidance systems and ground test validation of subsystem performance will begin. Participation of Defense Mapping Agency and potential using commands will increase for

validation of mission planning approach, identification of preferred tactical and/or strategic weapon applications, and captive flight demonstration planning.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: These funds are needed to continue the development and demonstration of two competing multi-purpose advanced guidance systems. Fabrication of the guidance systems and ground test validation of subsystem performance will be completed. Missile integration designs and engineering development plans will be developed. Cost estimates for this advanced development program were derived parametrically (cost category III - budgetary).

(4) (U) Program to Completion: This is a continuing program. Following comprehensive ground testing and aircraft integration of the guidance system hardware in FY 1986, captive flight test demonstrations of the multiple guidance functions will be accomplished for a wide variety of target types and simulated mission situations. The contractors will develop designs for integration of the advanced guidance systems into specific missile airframes. Using results from the flight test demonstration, mission planning concept validations, and operational utility assessment, the Air Force will develop recommendations for follow-on weapon applications of this advanced guidance technology beginning in FY 1987.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Critical Design Review	June 1985
(2) (U) Fabrication/Integration complete	1st Quarter FY 1987
(3) (U) Flight Demonstration Complete	March 1988

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63363F Title: Hypervelocity Missile (HVM)
DOD Mission Area: #553 - Engineering Technology (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		970	0*	10,763	9,790	TBD	TBD
2718	HYPERVELOCITY MISSILE TECHNOLOGY DEMONSTRATION	970	0*	10,763	9,790	TBD	TBD

* Congress deleted funds for the Air Force portion of this program in FY 1985, but indicated that a reprogramming action would be considered upon receipt of a new anti-armor master plan. Originally published in May 1984, this plan will be revised and forwarded to Congress by March 30, 1985. The Air Force has submitted a reprogramming action for $4 million in FY 1985. (An additional $3 million for FY 1985 was requested in PE 64604F, Submunition Development, for the Hypervelocity Submunition. This request was also deleted by Congress, and the reprogramming request identifies, under one PE, the funds required for the remainder of FY 1985.)

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Hypervelocity Missile (HVM) system concept incorporates a small, fast, low-cost laser-guided missile to achieve multiple vehicle kills on a single pass. The high aircraft loadout, resulting from the small missile size and low cost, affords a significant increase in kills per sortie. The Armament Division has devised a technology demonstration program that will culminate with the air-launched flight test of multiple missiles being fired and simultaneously guided to two different targets. Targeting information will be provided by a forward-looking infrared (FLIR) tracking system. This program will demonstrate the feasibility of the HVM concept, and will provide a basis for the decision to proceed with full-scale development (FSD). The HVM system concept promises to give the U.S. an impressive increase in firepower for the anti-vehicular mission, at an equally impressive decrease in cost per target destroyed. The Army and Marine Corps also strongly support the system for use on both light assault vehicles and helicopters. A Memorandum of Agreement between the three Services' Assistant Secretaries was signed on 10 October 1984, establishing a joint effort to share the costs of developing common components, and to conduct a joint ground-launched demonstration to validate the system concept. The Air Force is the lead Service in this effort, the first tri-Service antiarmor weapon development program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	RDT&E	970	2,994	0*		TBD	TBD

* Funding was increased $5.0 million by Congressional action to reflect the FY 1986 requirement for the Air Force share of the tri-Service ground-launched demonstration. Subsequent action by the Office of the Secretary of Defense provided an additional $5.763 million needed for the demonstration program.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: The US Army and US Marine Corps are working closely with the Air Force Armament Division on this program, determining its potential for use on their light assault vehicles. The US Army Aviation Command is considering the use of the HVM on helicopters. A Memorandum of Agreement (MOA) between the Air Force (AF), Army (USA) and Marine Corps (USMC), specifying that the three Services will share the costs of developing common components for their respective hypervelocity missile systems, was signed by the three Services' Assistant Secretaries on 10 October 1984. This MOA pertains to fiscal years 1984 through 1987, and will culminate in the successful ground launch and guidance of both the AF and USA/USMC missiles. The MOA also designates the Air Force as the lead Service. The USMC share of this program is being funded by PE 63611M, Mobile Protected Gun System, and the USA share is funded by PE 63313A, Missile/Rocket Components.

6. (U) WORK PERFORMED BY: The Air Force Armament Division, Eglin AFB, FL, is the responsible technical organization for this program. The U.S. Army Missile Command, Huntsville, AL, will provide support for U.S. Army requirements, as will the USMC Development and Education Center, Quantico MCAS, VA, for the Marine Corps requirements. Test facilities at the Armament Division, Eglin AFB, FL, and the White Sands Missile Range, NM, will be used to support the program. The primary contractor on this program is Vought Corporation, Dallas, TX.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: #2718, Hypervelocity Missile Technology Demonstration

A. (U) Project Description: The Hypervelocity Missile is a 5000 ft/sec, 60 lb, low cost ($10 thousand class), multiple target engagement weapon system for use against all vehicles, including armor. The HVM lethal mechanism represents a completely different approach from those used in current weapons. Instead of a chemical energy warhead, it uses a kinetic energy penetrator (rod or tube). This achieves a substantial reduction in missile size, weight and cost, while dramatically increasing the missile's flight velocity and the aircraft's combat load. These characteristics provide a marked increase in firepower-per-sortie, while simultaneously decreasing the aircraft's total exposure time. The high payoff potential of the HVM is that it can significantly increase the weapons available and the armament carried per sortie. The low cost per missile, combined with simple employment procedures, will reduce aircrew training costs. Additionally, the lack of an explosive will significantly reduce logistic costs.

Program Element: #63363F | Title: Hypervelocity Missile (HVM)
DOD Mission Area: #553 - Engineering Technology (ATD) | Budget Activity: #2 - Advanced Technology Development

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: An initial design analysis of the lightweight, high-speed missile was completed. Work was initiated for detailed missile design and associated documentation, including drawings and test equipment/launcher design requirements. The U.S. Marine Corps Mobile Protected Gun System (MPGS) Hypervelocity Missile (HVM) sizing study, and the Air Force Armament Test Lab in-house kinetic energy penetrator tests of tungsten rods were completed. Full-scale testing of a depleted uranium rod penetrator was initiated. A Memorandum of Agreement between the Air Force, Army and Marine Corps, establishing respective funding levels, emphasizing maximization of component commonality, and conducting joint testing through the ground-launched phase, was drafted and forwarded to the Service Secretaries for signature. Army and Marine Corps missile design efforts were initiated.

(2) (U) FY 1985 Program: FY 1985 funding will continue contractor design of the missiles, launchers and test equipment, and start integration of the launchers and missiles with the laser guidance system and the Forward Looking Infrared (FLIR) targeting system. Missile fabrications will be initiated.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Missile fabrications will be completed. System integrations for the ground-launched tests will be completed, and firings of the twelve missiles for the ground-launched phase will begin. Packaging of the fire control system, and targeting system/missile/aircraft integration and qualification analyses for the air-launched phase will be initiated. The cost information has been derived from detailed design analyses and firm contractor cost proposals (Category III).

(4) (U) Program to Completion: Missile/aircraft, targeting system/aircraft, and launch pod/aircraft integration and qualification will be completed. Single and multiple missile air-launched flight tests will be conducted if the ground-launched tests are successful. The Air Force plans reprogramming action to initiate this second phase. Successful completion of these air-launched tests in FY 1988 will conclude the HVM System Integration Demonstration. Concurrent studies will be conducted to address questions of full-scale development, production cost/schedule/risk, operational utility of the HVM weapon system concept for the Air Force's anti-vehicular mission, and weaponization concepts for tactical aircraft. The results of these tests and associated studies will support an FY 1988 decision to proceed to Full-Scale Development (FSD) of the HVM weapon concept.

C. (U) Major Milestones:

Milestones		Dates
(1) Preliminary Fire Control System Design Complete		October 1984
(2) Lightweight Missile Design Complete	*(April 1986)	July 1985
(3) Ground Test Demonstrations Complete	*(March 1987)	January 1987

Program Element: #63363F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Hypervelocity Missile (HVM)
Budget Activity: #2 - Advanced Technology Development

(4)	Flight Test Demonstration Complete	*(September 1988)	July 1988
(5)	FSD Decision		October 1988

* Date presented in Fiscal Year 1985 Descriptive Summary.

(U) EXPLANATION OF MILESTONE CHANGES:

(2,3,4) Dates were revised to reflect the goals under the newly established tri-Service Memorandum of Agreement.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63401F
DOD Mission Area: #410 - Space Launch and Orbital Support

Title: Advanced Spacecraft Technology
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		6,283	6,900	9,700	18,592	Continuing	N/A
2181	Advanced Space Computer Technology	3,168	5,540	7,750	14,850	Continuing	N/A
2198	Advanced Space Technology Planning	265	100	150	150	Continuing	N/A
681D	Advanced Space Guidance Technology	450	65	200	200	Continuing	N/A
682J	Advanced Space Power Supply Technology	2,400	1,195	1,600	3,392	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This technology program defines, develops, and demonstrates new/improved spacecraft subsystem concepts/prototypes which support numerous DOD space programs. The developments are essential to assure DOD space mission needs are met in the late 1980s and early 1990s. The primary objective of this program is to increase satellite autonomy, performance, reliability and lifetime. A secondary objective is to accomplish the performance improvements with lighter, less complex, and more economical subsystems than currently exist. Efforts include technology planning, and development of computer subsystems, power supplies, and guidance.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	Additional to Completion	Total Estimated Cost
RDT&E	6,283	30,726	28,913	Continuing	N/A

(U) The reduction in FY 1985 funding is the result of Congressional action. The reduction in FY 1986 is due to a reallocation to higher Air Force priorities.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Project 681D (Advanced Space Guidance Technology) receives technical planning inputs from Program Element (PE) #62204F (Aerospace Avionics). Project 682J (Advanced Space Power Supply Technology) receives power system technology inputs from PE #62203F (Aerospace Propulsion). Project 2181 (Advanced Space Computer Technology) receives technology inputs from PE 63452F, Very High Speed Integrated Circuits and PE 64711F, System Survivability (Nuclear Effects). The Advanced Spacecraft Technology program flight tests its payloads via PE 63402F (Space Test Program).

6. (U) WORK PERFORMED BY: The Air Force Space Technology Center, Kirtland AFB, NM, manages the program and executes Projects 681D, 2181, and 2198. The Air Force Aeropropulsion Laboratory, Wright-Patterson AFB, OH, executes Project 682J. The primary contractors are TRW Inc., Redondo Beach, CA (Project 681D--Multi-Mission Attitude Determination and Autonomous Navigation system); Hughes Aircraft Co., El Segundo, CA (Project 682J--Solar Cells and Batteries); the Jet Propulsion Laboratory, Pasadena, CA (Project 2181--Satellite Autonomy); Sandia National Laboratory, Albuquerque, NM (Project 2181--Space Hardened Electronics) and General Research Corp., McLean, VA (Project 2198--Military Space Systems Technology Plan).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2181, Advanced Space Computer Technology. This project includes Satellite Autonomy and Space Hardened Electronics which cooperatively increase the survivability and onboard data processing capability of military space systems. Military satellites are key links in the U.S. warfighting capability and must be survivable commensurate with the supported forces. These satellites currently require extensive support from vulnerable ground stations, and therefore need satellite autonomy to eliminate this vulnerability. In addition, advanced electronics hardened to survive the space environment pace satellite mission performance. Future missions have identified the need for a factor of 10 to 100 improvement in onboard processing capability. Development and initial commercial production of a 16 kilo-bit (K) space-qualified radiation hardened Random Access Memory (RAM) chip was completed and process development was initiated for a 64K RAM, a 256K Electrically Alterable Read Only Memory (EAROM), and a 256K Read Only Memory (ROM). Also in FY 1984, a basic methodology and cell family was defined for the standard cell library, an advanced memory process to design logic circuits. Study results indicated a significant throughput penalty would occur if commercial instruction sets were adapted to execute Military Standard-1750A instructions, and thus this effort was cancelled. A preliminary design review of the Autonomous Redundancy and Maintenance Management Subsystem (ARMMS) hardware, software, and demonstration subsystem was conducted during FY 1984. Development of a cost/benefit model to select optimum autonomy enhancements for satellite block upgrades was initiated in FY 1984. Due to an 1985 budget reduction, the ARMMS development will be terminated in FY 1985. Development of the 64K RAM, 256K EAROM, and 256K ROM will be continued. Development of advanced bubble memory devices will be initiated. Testing of the standard cell library is also scheduled. Modifications of microelectronic Computer Aided Design (CAD) tools needed to develop radiation hardened electronics for space applications will be deter-

mined. Investigation of the application of artificial intelligence to the implementation of spacecraft autonomy will be pursued. A microelectronic package to fly on the Combined Release and Radiation Effects Satellite (CRRES) will be completed. The FY 1986 program will continue to develop and demonstrate technology for computer memory storage, software subsystems, and components. These subsystems and components will have increased radiation hardness to enhance satellite survivability, will decrease satellite-to-ground link requirements, and will have reduced weight, volume, power, and cost relative to today's state-of-the-art technology. Government laboratory testing of radiation hardened components will be initiated to obtain an independent expertise for verifying/qualifying devices. A radiation shielding experiment will be developed and integrated into CRRES. Continuation of 64K Random Access Memory (RAM), 256K Electrically Alterable Read Only Memory (EAROM), and 256K Read Only Memory (ROM) programs will lead to space qualified parts in FY 1988. The Very High Speed Integrated Circuit (VHSIC) insertion effort for the generic spaceborne computer will begin in FY 1987. Cost estimates for this project are preliminary, but include some negotiated contracts. This is an advanced development, continuing program.

B. (U) Project: 2198, Advanced Space Technology Planning: This project develops tools for planning and managing technology initiatives for advanced space systems through the Military Space Systems Technology Plan (MSSTP). The modeling process includes: (1) identifying and ranking major military space missions, (2) developing advanced space systems concepts, (3) identifying key technology needs, (4) creating technology development roadmaps, and (5) prioritizing technolgy development thrusts. The third edition of the MSSTP, Volumes I through VI, was published in the fourth quarter of FY 1984. This edition included technology development roadmaps and a prioritized technology program plan which were not part of the first two editions. Volume VI is intended to serve as the Air Force Systems Command (AFSC) space technology reference document. During FY 1985, comments on the third edition MSSTP from Air Force labs, and other agencies will be incorporated into the document. The FY 1986 program will include continued revision of the third edition to reflect the continued evolution of technology requirements and development priorities. New initiatives will also be proposed. This is a continuing program.

C. (U) Project: 681D, Advanced Space Guidance Technology: This project develops and demonstrates technologies for space guidance which will provide autonomous, non-radiating navigation for satellites and improve inertial attitude reference accuracies. This project has been developing the Multi-mission Attitude Determination and Autonomous Navigation (MADAN) sensor; an accurate, solid-state, strapdown star sensor capable of supporting forseeable satellite navigational needs. In FY 1984, all hardware components for the laboratory demonstration of MADAN were fabricated. In FY 1985, however, the MADAN effort will be phased out to a reduction in the FY 1985 appropriations. In FY 1986, this project will investigate follow-on navigation, guidance, attitude determination, and pointing/control technologies. This is a continuing program.

D. (U) Project: 682J, Advanced Space Power Supply Technology: This project develops and demonstrates power system technology for subsystems and components. These technologies will provide increased power output and lifetime; substantially reduced volume, cost, and weight; and increased nuclear and laser hardness. Planned development efforts

include: Gallium Arsenide (GaAs) solar cells, Nickel-Hydrogen (NiH_2) batteries, high energy density Sodium Sulfur (NaS) rechargeable battery, survivable solar concentrators, and a lightweight solar array blanket incorporating advanced multi-band gap GaAs solar cells. In FY 1984, the Common Pressure Vessel (CPV) NiH_2 battery development was terminated due to experimental results indicating its cost ineffectiveness. This effort was redirected to the high capacity 4.5 inch Individual Pressure Vessel (IPV) cell. Development was completed of a GaAs solar panel for a space flight evaluation in a high radiation environment. Successful reduction and analysis of the data from the Navy Living Instrument Plume Shield (LIPS) flight tests of GaAs cells was accomplished. The FY 1985 program will continue development of the 4.5 inch NiH_2 IPV cell. A performance data base will be established by testing the cells in simulated orbits. Support will be provided for the Combined Release and Radiation Effects Satellite (CRRES) experimental test of GaAs solar panels. Development programs will be initiated for a High Energy Density Rechargeable Battery (HEDRB) based on the Department of Energy's research on Sodium-Sulfur batteries, and for survivable solar concentrator panels. The FY 1986 program will continue to design, develop, and demonstrate satellite system technologies to provide necessary increased power generation, storage, and conditioning capabilities. The 4.5 inch NiH_2 IPV cells will be demonstrated by the end of FY 1986. Work will continued on the development of advanced technology batteries and solar panels. Cost estimates for this project are preliminary but include some negotiated contracts. This is an advanced development, continuing program.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63406F Title: Advanced Military Spaceflight Technology
DOD Mission Area: #410 - Space Launch and Orbital Support Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	916	8,436	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This new start provides the background analysis for a future Military Aerospace Plane (MAP). The MAP is defined as a hybrid spacecraft-aircraft system, which can ascend from the earth's surface into near space, maneuver, and return for an airfield landing after less than one or more earth orbits. This program examines the concepts for a vehicle uniquely tailored to military mission requirements.

The MAP combines the best features of aircraft and space launch boosters, providing flexible, survivable, responsive and affordable access to space. To design such a vehicle, a complete concept and utility analysis is needed first. Priority of missions and concept definition influence the follow-on efforts in technology development for the MAP. Research in this program will help in the decision process when the MAP concept is mature enough to reach a program decision point. If a MAP is to be developed, it will be accomplished under a different, vehicle specific program element.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	0	2,829	8,936		Continuing	N/A

(U) The program was a proposed new start in FY 1985, and approved at $1 million by the Authorization Conference Committee; however, no funds were appropriated by Congress. The Senate Appropriation Committee's report indicated that this program should change its near-term focus from technology development to concept exploration and definition, before proceeding with a technology program. The FY 1986 reduction reflects a rephasing of the program and redefinition of near-term objectives.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: There are no related technology development efforts.

6. (U) WORK PERFORMED BY: Air Force Systems Command will manage the program with participation by the Strategic Air Command and Space Command. No contracts have been awarded.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 63406F, Advanced Military Spaceflight Technology

A. Project Description: This is the Department of Defense's only program to define and develop space plane candidates and technology for military space missions in the 1990's and beyond. It includes the background work for mission utility, concept analysis and follow-on technology support necessary for the Military Aerospace Plane (MAP).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The program was not funded in FY 1984. Concepts for a MAP were examined by Air Force personnel to evaluate the feasibility of such a vehicle. Potential uses of the concept were evaluated by Air Force operating commands.

(2) (U) FY 1985 Program: The program was not funded in 1985. Air Force internal analysis will continue. Command requirements will be examined and preliminary statements of work for the FY 1986 effort will be prepared.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Following Congressional direction, missions for the earth-to-space military vehicle will be examined and system utility will be compared with alternatives. Concept studies will be performed to derive the most responsive approach. The product of this investigation will be a prioritized list of missions and a candidate generic concept. Parametric costing was used in estimating costs, cost estimation category IV. Since this is a new start, the program is in conceptual development.

(4) (U) Program to Completion: Once the mission utility assessment is completed and a generic concept is determined, critical technologies will be derived and roadmaps will be developed. Technology roadmaps will be prepared to define the goals, schedule and cost of the research effort. Candidate limiting technologies will then be explored. The program will continue to examine prototype subsystems and materials, and qualify manufacturing processes. Sample materials will be manufactured and tested. This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Program Start	*(FY 85) November 1985
(2) (U) Mission Utility Assessment Contract Award	January 1986
(3) (U) Mission Utility Assessment Contract Complete	April 1986
(4) (U) Concept Evaluation Contract Awarded	July 1986

* Date Presented in FY 1985 Descriptive Summary

EXPLANATION OF MILESTONE CHANGES

(1) (U) Program not authorized by Congress.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63410F — Title: Space Systems Environmental Interactions Technology
DOD Mission Area: #552 - Environmental and Life Sciences (ATD) — Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,420	3,730	4,954	9,859	Continuing	N/A
2821	Space Systems Design and Test Standards	206	600	800	1,453	Continuing	N/A
2822	Interactions Measurement Payload	621	2,300	3,200	7,306	Continuing	N/A
2823	Charge Control System	593	830	954	1,100	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The space environment can seriously degrade operation and performance of large, high-power space systems planned for operation in the 1990's. These new systems will not meet the most stringent requirements for survivability, reliability, autonomony and long-lived operation unless they are designed to minimize these degrading environmental effects. Impacts identified by recent experiments from Shuttle and other satellites include: upsets of on-board micro-electronics; spacecraft charging/discharging during polar orbit; deformation of radar antenna or large-system optics; power loss and materials damage of large solar arrays caused by interaction with space plasma; possible limits on manned operations due to charging/discharging of extra-vehicular activity equipment; decreased materials stability associated with increased contaminants; and significant materials degradation caused by space environment interaction. This program counters potential system limiting effects of the space environment on Air Force space systems by developing design guidelines, test standards, and computer aided design codes for inclusion in Military Standards for advanced space systems. A charge control system will be developed and space flight-qualified to automatically control electrical charge buildup on spacecraft. Engineering design tools and a space flight-qualified charge control system will be delivered to system developers. Program Element 63410F represents the Air Force advanced development portion of a joint National Aeronautics and Space Administration (NASA)/Air Force Systems Command (AFSC) Agreement for Space Interdependency on Spacecraft-Environment Interaction. This is a Science and Technology Program. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,045	3,730	5,063		32,162	43,000

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The principal related activity is the NASA (Office of Aeronautics and Space Technology)/USAF(AFSC) Space Interdependency on Spacecraft-Environment Interaction agreement of May 1980. Both NASA and AFSC are coordinating exploratory development technology which this program will transition into the solutions to specific space systems problems. A major Air Force input is from exploratory development Projects 7661 and 7601 in Program Element 62101F, Geophysics, at the Air Force Geophysics Laboratory. Programs in the broad area of the space environment are also conducted by the Navy and the National Oceanic and Atmospheric Administration. These efforts are reviewed and coordinated formally with PE 63410F at the annual tri-service Science and Technology program review by the Office of the Under Secretary of Defense for Research and Engineering. The NASA/USAF Space Technology Interdependency Working Group coordinates the NASA/USAF efforts continuously and reviews the programs at semiannual meetings. This program is reviewed and coordinated annually by Air Force Systems Command Space Division, major developer of Air Force space systems.

6. (U) WORK PERFORMED BY: This combined in-house and contract program is being managed by the Air Force Geophysics Laboratory, Hanscom AFB, MA. Jet Propulsion Laboratory, Pasadena, CA (2822), Hughes Research Laboratories, Malibu, CA (2823), d TRW Space and Technology Group, Redondo Beach, CA (2821), are currently the only contractors in this program element.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2821 - Design and Test Standards. Project 2821 applies the results of NASA and DOD spacecraft-environment interaction research and technology development programs to produce design guidelines and test standards for large, high-power space systems. Computer-aided engineering (CAE) design tools will be developed to identify environmental sensitivities in space system designs. In FY 1984, DOD, NASA and private industry research into space environment interactions was integrated to define the technologies with potential system-limiting effects. In FY 1985, a baseline of the state-of-the-art understanding of these interactions will be established, mature technologies will be identified and direction for further experimental development will be laid out. In FY 1986, available research results on mature technologies will be incorporated into existing or new military standard design guidelines and test standards. Existing computer models will be developed into computer aided design tools.

B. (U) Project: 2822 - Interactions Measurement Payload. The first Interactions Measurement Payload for Shuttle (IMPS) planned for FY 1987 will quantify the effects of the polar-auroral environment on materials, equipment, and technologies to be used in large, high-powered AF space systems of the 1990s. Payload content definition began in FY 1983 by an Engineering Science Working Group composed of AF Laboratory, NASA Center and major contractor representatives, with representation from Office of the Under Secretary of Defense for Research and Engineering. The proposed complement of engineering experiments for the first Interactions Measurement Payload for Shuttle (IMPS) mission includes experiments on solar-array operation, spacecraft materials contamination, space-based radar components performance and materials damage caused by plasma interactions. IMPS results will provide information which will be used to prevent operational failures due to unanticipated environmental effects and minimize costly downstream redesign of expensive space systems. IMPS output will provide direct input and validation for design guidelines and test standards for

planned military space systems. In FY 1984, the baseline definition and selection of experiments for the first Interactions Measurement Payload were completed. In FY 1985, an IMPS implementation plan and cost estimate will be completed. Definition of the individual experiments for IMPS will begin, to include the specific experiments mentioned above as well as an environmental specification package. FY 1986 efforts involve design, fabrication, and assembly of the initial IMPS payload for a Polar Shuttle Flight in FY 1987.

C. (U) Project: 2823 - Charge Control System. An automated Charge Control System (CCS) will be designed, developed and flight tested to produce a small, spaceflight-qualified system to actively control charge buildup on mission spacecraft. The buildup of large differential electrical charge on spacecraft and the subsequent catastrophic discharge (arcing) can degrade system operation, cause damage to the spacecraft and reduce system performance. The CCS is based on experimental charge emission devices demonstrated in exploratory development on satellite P78-2, which was designed to explore operational anomalies on geosynchronous satellites. Preliminary design and breadboard construction of the CCS were completed in FY 1984. Breadboard testing and detailed engineering will be completed and component fabrication begun in FY 1985. In FY 1986, fabrication and system integration of the CCS flight unit will be completed and ground testing will begin. The CCS flight unit will be delivered to the Space Test Program for demonstration aboard a geosynchronous satellite in early FY 1988.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63424F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Missile Surveillance Technology
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		11,128	3,000	11,550	15,584	Continuing	N/A
3010	Teal Ruby Mission Planning	4,999	2,000	7,600	4,000	1,000	29,398
2123	Cruise Missile Surveillance Technology	6,129	1,000	3,950	11,584	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides proven technology to reduce full scale development risk and to guide the design of space-based systems for missile detection. In the past, this program dealt exclusively with ballistic missiles. This effort was changed in 1985 to develop and demonstrate the technical feasibility of concepts and critical subsystems for space-based surveillance, detection, discrimination, warning, and tracking of cruise missiles. This new thrust responds to growing concerns over our capability to detect the projected Soviet cruise missile threat.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	7,129	6,985	9,950		Continuing	N/A

FY 1984 increase of $4.0 million and FY 1986 increase of $1.6 million is for the mission planning and data reduction associated with the Teal Ruby Program.

FY 1985 decrease of $4.0 million represents funds cut by the Congress.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The Atmospheric Surveillance Technology (PE 63716F) program is developing ground-based and airborne sensor concepts applicable to cruise missile detection. The Defense Advanced Research Projects Agency is developing the Teal Ruby sensor (PE 63226E, Experimental Evaluation of Major Innovative Technology). The Space Test Program (PE 63402F) is developing the spacecraft and will fly the Teal Ruby experimental sensor.

6. (U) WORK PERFORMED BY: Primary contractors include: Martin Marietta Corporation, Denver, CO (ultraviolet sensors); Honeywell Radiation Center, Lexington, MA (spectral radiometers); Aerodyne Inc., Burlington, MA (computer data analysis); and E-Systems Melpar Div., Falls Church, VA (mission planning). The Air Force Space Technology Center (AFSTC), Kirtland AFB, NM, is responsible for the management of the PE. Additional DOD agencies are the Air Force Geophysics Laboratory, Hanscom AFB, MA; White Sands Missile Range, NM; and Air Force Wright Aeronautical Laboratories, WrightPatterson AFB, OH.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 3010, Teal Ruby Mission Planning. The Teal Ruby experiment is a Defense Advanced Research Projects Agency (DARPA) development to assess a space-based capability for infrared detection of airborne targets. When launched, the Teal Ruby spacecraft will provide the initial demonstration of a space-based infrared sensor designed to acquire, identify and track aircraft and cruise missiles. During a year on-orbit, Teal Ruby will collect measurements on signatures from low intensity air-breathing targets. This data is the key to eventual development of a space-based, wide area surveillance system. This companion project will develop mission plans for the Teal Ruby experiment, develop mission data reduction software, and analyze the mission data. Mission planning and data reduction software were initiated in FY 1984. Real time mission planning and data collection will continue for approximately one year. Data reduction will continue through FY 1988.

B. (U) Project: 2123, Cruise Missile Surveillance Technology. Under this project, infrared data has been collected and analyzed to guide system design of space-based systems for ballistic missile detection. In June 1984, the last of a series of high altitude balloon flights was conducted at Corpus Christi Naval Air Station in Texas. These balloon flights carried infrared detectors to measure the background radiation from various types of terrain. This aspect is complete, and the project was changed in 1985 to emphasize development and demonstration of space-based technologies for detecting and tracking cruise missiles. The purpose of this cruise missile surveillance project is to evaluate feasible concepts for cruise missile detection and tracking from space platforms, develop the key technologies required, demonstrate their performance, and provide a confident basis for any future decision on a full scale system development. The Air Force has initiated technology concept assessments and infrared, radar, and visible phenomenology measurements associated with cruise missile flights against low contrast earth backgrounds. In August 1984 the first attempt was made at collecting Airborne Warning and Control System (AWACS) radar data on a U.S. Sea Launched Cruise Missile. This data collection effort will continue in FY 1985, and in FY 1986 initial ground tests will be conducted to support system concept definition and demonstration of critical sensor components. Promising concepts will be selected for flight testing. Technology development tests and feasibility component demonstrations will support a system development decision in FY 1989.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63452F
DOD Mission Area: #551-Electronic and Physical Sciences (ATD)

Title: Very High Speed Integrated Citcuits (VHSIC)
Budget Activity: #2-Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		120,109	135,000	193,776	158,224	112,134	934,844
2700	VHSIC	120,109	135,000	193,776	158,224	112,134	934,844

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a Tri-Service program to develop two generations of integrated circuits with very high data processing capacity for a wide range of military systems. Initial applications include digital signal processors for radar, antisubmarine warfare, communications, missile guidance, electronic warfare, and optical sensor systems. Payoff in these systems will include enhanced performance and reliability and reduced life-cycle cost. Many systems will not be achievable without this component technology. The program structure stresses ready access to the technology by military system designers and rapid introduction of these components into the operational inventory. By Congressional direction, the program is centrally managed in the Office of the Under Secretary of Defense for Research and Engineering, and the Air Force budgets for and administers the total program funding for all the services. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY : ($ in thousands)

RDT&E	120,109	119,978	102,910		115,408	673,970

EXPLANATION: (U) The additional funding expands the technology insertion program; provides improved radiation hardness of the integrated circuits; supports additional packaging and military qualification activities; and provides a strong and aggressive development of second generation (submicrometer) integrated circuit chips.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This is a Tri-Service program with management and technical oversight executed by the Office of the Under Secretary of Defense for Research and Engineering. The Director, VHSIC and Electron Devices, in the Office of the Under Secretary of Defense for Research and Engineering, coordinates the work within the program and work related to it. An Executive Committee chaired by the Deputy Undersecretary of Defense for Research and Engineering, Research and Advanced Technology with participation by the Services and other concerned agencies exercises oversight and sets program policy. Related activities include: Aircraft Avionics, (PE 62202A); Electonic and Electron

Devices, (PE 62705A); Electron Device Technology, (PE 62762N); Aerospace Avionics, (PE 62204F); Aircraft Avionics Equipment, (PE 63207A); Avionics, (PE 63202N); Advanced Device Development, (PE 63742N); Advanced Avionics for Aircraft, (PE 63203F); Electronic Warfare Technology, (PE 63718F); and Advanced Systems Integration Demonstrations, (PE 63253F). In addition, a major manufacturing technology program will be conducted to ensure VHSIC components are mature, available, and affordable. The Defense Nuclear Agency, in conjunction with the VHSIC Program Office is conducting programs with all six VHSIC Phase I chip fabrication contractors to evaluate the use of state-of-the-art radiation hardening techniques to upgrade VHSIC pilot production lines to space and strategic hardening levels.

6. (U) WORK PERFORMED BY: The Office of the Under Secretary of Defense for Research and Engineering executes program management of Very High Speed Integrated Circuits. The work is monitored in the following organizations: Electronic Technology and Device Laboratories, Electronic Warfare Laboratory, and Communications Research and Development Command, all of Fort Monmouth, NJ; Army Missile Command, Huntsville, AL; Army Armament Research and Development Command, Cover, NJ; Army Night Vision and Electro-Optics Laboratory, Fort Belvoir, VA; Army Research Office, Research Triangle Park, NC; Naval Electronic Systems Command, Naval Research Laboratories, both in Washington, DC; Office of Naval Research, Arlington, VA; Naval Air Development Center, Warminster, PA; Naval Surface Weapons Center, Dahlgren, VA and White Oak, MD; Naval Weapons Center, China Lake, CA; Naval Ocean Systems Center, San Diego, CA; Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH; and Rome Air Development Center, Griffiss Air Force Base, NY and Hanscom Air Force Base, MA. The major VHSIC contractors are TRW, Redondo Beach, CA; Westinghouse, Baltimore, MD; Hughes Aircraft Corp., El Segundo, CA; Texas Instruments, Dallas, TX; Honeywell Inc., Minneapolis, MN; IBM Corp, Manassas, VA; Harris Corp, Melbourne, FL; RCA, Camden, NJ; and Western Electric Company/Bell Laboratories, Murray Hill, NJ. There are eleven additional contractors holding contracts totalling $34.2 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2700, VHSIC

A. (U) Project Description: VHSIC contractors will deliver chip sets, brassboard demonstration subsystems, pilot production lines, computer-aided design tools, and government-funded technology. Numerous systems in all three Services have been identified as prime candidates for VHSIC designs. Projected system payoffs include 5- to 10-fold reductions in size, weight, and power consumption; 10- to 100-fold increases in reliability and processing throughput; and significantly reduced costs of maintenance, supply, and modification. Program phases are as follows: Phase 1 - first generation militarized very large-scale integration technology using 1.25 micrometer geometries to fit 20,000-50,000 logic gates per chip; Phase 2 - second generation technology, using submicrometer geometries and 100,000 or more gates per chip, yield enhancement in Phase 1 pilot lines, computer-aided design tools, and support for initial system applications of Phase 1 chips; Phase 3 - parallel program of supporting technology efforts to meet needs and reduce risk in Phases 1 and 2.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The first VHSIC Phase 1 brassboard, pilot line, computer aided design tools, and data were delivered. A total of 11 different VHSIC chips were demonstrated fully functional. The Phase 1 yield enhancement program was begun. A second group of technology insertion projects were initiated, involving the system acquisition and logistics communities of all three services. A series of VHSIC Technology Application workshops were conducted across the country to aid the rapid transition of Phase 1 technology into the defense industrial base.

(2) (U) FY 1985 Program: Phase 1 will be completed with delivery of all chips, brassboards, pilot lines, computer-aided design tools, and data. The FY 1985 program contains a balance of activities both to advance militarized very large scale integration to the submicrometer regime needed for advanced high-throughput processors and to quickly realize the potential of Phase 1 VHSIC technology in multiple operational systems. Parallel contracts were awarded to establish submicrometer pilot lines and design second generation chips and brassboards, with emphasis on demonstrating the necessary chip fabrication processes and defining detailed chip and brassboard specifications. The Phase 1 yield enhancement thrust will support a wide range of efforts tailored to specific production problems in the various Phase 1 pilot lines. The initial VHSIC Hardware Description Language (VHDL) tools will be delivered, and the Integrated Design Automation System (IDAS) thrust will continue to develop a design environment which can cope with the complexity of VHSIC chips and systems, and which makes maximum utilization of developments in the DOD Software Technology Initiative and the Ada programming language. Phase 1 chips will become available in sufficient quantities to permit prototyping and evaluation by qualified defense industry concerns, and the number and range of specific system application projects will continue to expand. A small part of program funding will continue for management and support activities.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The Phase 1 yield enhancement thrust will continue through FY 1986. By late FY 1986, Phase 1 chips will be entering volume production and will be incorporated into a wide assortment of new designs, modifications, and upgrades of operational systems. The initial Ada-compatible design environment from the IDAS thrust will be assembled in FY 1986 and enter testing in various government and industrial organizations. This design facility will continue to be expanded and refined to incorporate advanced design automation methods and to keep pace with the delivery of Phase 2 chips and brassboards. The submicrometer technology development will continue. Funding estimates are based on detailed program planning and analysis performed by Service experts in design automation, manufacturing technology, reliability and testing, and other disciplines; and on experience gained in similar activities in the program, including firm contract pricing for efforts now in progress.

(4) (U) Program to Completion: The VHSIC Phase 1 yield enhancement and manufacturing technology efforts will be completed in FY 1987. The submicrometer thrust of Phase 2 will end in FY 1988 with delivery of chips, brassboards, pilot fabrication lines, and associated technology and data. Support for system applications will continue through program completion in FY 1990.

C. (U) Major Milestones: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63454F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Non-Destructive Inspection Development
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	980	4,507	Continuing	N/A
3153	Non-Destructive Inspection Advanced Development	0	0	980	4,507		

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This FY 1986 new start has the objective of accelerating the demonstration, integration, and application of new nondestructive inspection and evaluation (NDI/NDE) technology necessary to satisfy critical depot level and initial manufacturing quality, integrity, and safety assurance requirement The introduction of composite materials and advanced structural high performance jet engine alloys into the operational inventory demands the ability to perform real time inspections in excess of current capability. Newly developed laboratory Nondestructive Inspection technology must be validated and transitioned into forms useful for field, depot, and manufacturing plant applications. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not applicable.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: Coordination with other Department of Defense and governmental activities is maintained under strong guidance of the Office of the Secretary of Defense's technical staff. Activities such as the Tri-Service Metal-Matrix Composite Steering Group, the Joint Logistics Commander's Panel on Non-Destructive Inspection, the Tri-Service Laser Hardening Materials and Structures Working Group, selected activities of the Office of Science and Technology Policy Committee on Materials, and bi-annual Department of Defense Materials and Structures Conferences foster development of a strong, nonredundant program. Close relationships are maintained with the National Aeronautics and Space Administration in areas of mutual interest. This program element is meshed with portions of the Air Force Manufacturing Technology Program (Program Element 78011F), with results of each program element feeding the other; with Aerospace Flight Dynamics (Program Element 62201F), Materials (Program Element 62102F), and Aerospace Propulsion (Program Element 62203F) each of which provide the basic technology for further development within this program element.

Program Element: #63454F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Non-Destructive Inspection Development
Budget Activity: #2 - Advanced Technology Development

6. (U) WORK PERFORMED BY: This program is managed by the Materials Laboratory, Wright-Patterson AFB, OH.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3153, Non-Destructive Inspection Development

A. (U) Project Description: The objective of this FY 1986 new start program element is accelerating the demonstration, integration, and application of new nondestructive inspection and evaluation (NDI/NDE) technology necessary to satisfy critical depot level and initial manufacturing quality, integrity, and safety assurance requirements. The introduction of composite materials and advanced structural high performance jet engine alloys into the operational inventory demands the ability to perform real time inspections in excess of current capability. Newly developed laboratory Nondestructive Inspection technology must be validated and transitioned into forms useful for field, depot, and manufacturing plant applications.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable.

(2) (U) FY 1985 Program: Not applicable.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The introduction of composite materials and advanced structural high performance jet engine alloys into the operational inventory demands the ability to perform real time inspections in excess of current capability. Programs will be initiated to apply new NDI/NDE, instrumentation, and signal processing developments to the inspection of advanced composite materials and structures, and to accurately detect critical flaws in high performance jet engine components.

(4) (U) Program to Completion: Continue FY 1986 programs and initiate efforts to apply NDI/NDE technologies to (a) the detection of hidden corrosion, (b) the inspection of precision cast metal structural components, (c) address increased consistency, reliability, and cost-effective inspection techniques, and (d) establish/validate new high sensitivity detection and analysis capabilities like X-ray computed tomography. This is a continuing program.

C. (U) Major Milestones: Not applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63601F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Conventional Weapons
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		18,100	20,749	28,590	34,431	Continuing	N/A
670A	Ordnance Technology	12,200	6,695	8,500	13,146	Continuing	N/A
670B	Guidance Technology	5,900	14,054	19,890	19,285	Continuing	N/A
3072	Retaliatory Chemical Technology	0	0	200	2,000	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Funds the advanced development and technology base demonstration of advanced non-nuclear aircraft armament and weapons guidance technologies. New weapon concepts and technology applications are developed and tested to demonstrate feasibility, effectiveness and operational potential. This program serves as the basis for follow-on system development and advanced prototyping programs.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	18,000	21,749	28,687		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program demonstrates non-nuclear technologies initially investigated in Air Force exploratory development Conventional Munitions (PE 62602F), Aerospace Avionics (PE 62204F) and Rocket Propulsion (PE 62302F) programs. Coordination is maintained with Advanced Avionics for Aircraft (PE 63203F), Digital Avionics Information System (PE 63243F), Advanced Attack Weapons (PE 63609F), and NAVSTAR/Global Positioning System (PE 64778F) programs. Outputs from this technology base program are transferred to: Advanced Medium Range Air-to-Air Missile (AMRAAM) (PE 64314F), Advanced Attack Weapons (PE 63609F), Armament/Ordnance Development (PE 64602F), Submunitions (PE 64604F), and Surface Defense Suppression (PE 64733F) programs. Tri-Service coordination is accomplished through the Joint Technical Coordinating Group (JTCG) for Munitions Development and the JTCG for Munitions Effectiveness and the Joint Service Guidance and Control Committee. Other joint specialized committees have been formed for specific

technology sub-areas. Jointly funded/sponsored tasks in this program include the Very High Speed Integrated Circuit (VHSIC) technology in the Infrared High Value Target Acquisition (IRHVTA) program. International cooperation and coordination is under the auspices of the Technical Cooperation Program and various specific country-to-country data exchange agreements, such as the NATO programs for infrared and millimeter wave target/background signature measurements.

6. (U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base, FL is the responsible technical activity for this program. Test facilities at the Armament Division, Eglin Air Force Base, FL; the Arnold Engineering Development Center, Arnold Air Force Station, TN; and the Central Inertial Guidance Test Facility, MD support this program. Major contractors on this program are: General Dynamics Corporation, Pomona, CA; Texas Instruments, Dallas, TX; Control Data Corporation, Rockville, MD; ARES Inc., Port Clinton, OH; and General Electric Co., Burlington, VT. Eleven other contractors and non-Air Force Government activities hold additional contracts valued at $15.5 Million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 670A, Ordnance Technology. This project consolidates development and demonstration of key technology for modern warheads, fuzes, cluster weapons, anti-armor munitions, suspension and release equipment, advanced aircraft guns, ammunition, advanced weapon airframe integration, and insensitive high explosives. In FY 1984, the Improved 2000 pound warhead completed advanced development and was selected for accelerated full scale engineering development in PE 64602F Armament/Ordnance Development. The Standardized Avionics Integrated Fuzing (SAIF) project was completed and will be integrated with the Advanced Fighter Technology Integration (AFTI) F-16 flight test project in FY 1985. Large scale testing of various alternative insensitive high explosives and design of the Airfield Denial Submunition was continued. In FY 1985, the advanced development of the Airfield Denial Submunition will be completed. The high velocity 30MM cartridge and sabot diverter will be demonstrated. The AFTI F-16 demonstration of the SAIF technology will be completed. Development and testing of advanced aerial gun ammunition will continue. Advanced dispenser/airframe technologies will be demonstrated in full scale ground and flight tests. This effort will demonstrate various low drag, low observable designs and dispensing techniques which will feed future weapons development. In FY 1986, development of a hard target weapon to defeat hardened buried targets, which today can be defeated only with nuclear weapons, will begin. To address a serious theater storage and maintainability problem, large scale testing of alternative insensitive high explosives will continue.

B. (U) Project: 3072, Retaliatory Chemical Technology. This is an FY 1986 new start. This advanced development project will initiate a study to evaluate alternative approaches to the packaging and dispersing of chemical agents from advanced dispensers and standoff weapons. Models of dissemination concepts identified in supporting exploratory development efforts will be fabricated and tested. These models will then be integrated with associated delivery hardware and subsystems for flight test and evaluation. This project supports the United States' policy to deter chemical warfare. Current US chemical weapons do not represent a credible deterrent. A standoff air-launched capability is required. This is the only Department of Defense program to address that requirement.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 670B, Guidance Technology

A. (U) Project Description: This technology base effort provides development and demonstration of terminal and midcourse guidance components, low cost inertial systems and systems integration technology, and developments to provide tactical forces with improved air-to-air and air-to-surface missile capabilities.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The Tactical Global Positioning System (TGPS)/Midcourse Guidance Demonstration was successfully concluded and is ready for weapon system integration. The Infrared High Value Target Acquisition (IRHVTA) project completed slow speed captive carry tests of an autonomous seeker. The Advanced Seeker Technology for Air-to-Air Missiles (ASTAAM) program completed the detailed design of an advanced seeker and began preparations for a captive flight test program. Technology survey and planning efforts for the development of the Self-Protection Weapon (SPW) were completed.

(2) (U) FY 1985 Program: The IRHVTA program will be continued through high speed captive flight testing of a form, fit, and function imaging infrared seeker. Development of a Very High Speed Integrated Circuitry (VHSIC) brassboard processor for the IRHVTA algorithms will continue. The ASTAAM program will demonstrate, through captive carry flight testing, an advanced guidance system for air-to-air missiles. Advanced Synthetic Aperature Radar (SAR) and signal processing techniques will be investigated for application in an autonomous adverse weather guidance system. Advanced development of the guidance unit for an anti-radiation Self Protection Weapon (SPW) will begin in FY 85.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In FY 1986 this program will continue development of autonomous guidance systems through the Infrared High Value Target Acquisition (IRHVTA) project and the Autonomous Adverse Weather Guidance Technology project. The development of an autonomous lock-on-after-launch guidance will eliminate dependence on laser designators and data link pods, and provide long range standoff weapons with precision accuracy. Advanced development of the guidance unit for an anti-radiation Self Protection Weapon (SPW) will be completed. SPW will increase overall force survivability against short-range, low altitude, surface-to-air threats. This guidance unit is being developed to perform effectively with minimum avionics interface to insure compatibility with all tactical aircraft. The Advanced Seeker Technology for Air-to-Air Missiles (ASTAAM) project will complete captive carry demonstration of an advanced seeker which will improve beyond visual range standoff launch, outshoot, and the Electronics Counter Counter Measures (ECCM) capabilities of future seekers.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63605F — Titled: Advanced Radiation Technology
DOD Mission Area: #554 - Directed Energy Technology (ATD) — Budget Activity: #2 - Advanced Technology Development

1. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		46,680	5,000	19,749	52,002	Continuing	N/A
317J	Advanced Radiation Technology	46,680	0	0	0	N/A	N/A
3150	Laser Device Technology	0	515			Continuing	N/A
3151	Optics and Beam Control Technology	0	4,235			Continuing	N/A
3152	Technology Development Support	0	250			Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the Air Force Technology Program to establish the technical feasibility of high energy laser weapons for Air Force tactical and other broad based, generic applications. In prior development efforts within this PE, the basic feasibility of high energy lasers in short range (5km) applications has been successfully demonstrated. These results, coupled with continuing technology applications analyses, indicate that high energy laser weapons will have a high payoff in a broad range of Air Force tactical applications, such as aircraft defense against missiles or other aircraft. To provide the technology for the possible development of such weapon systems, additional technology development is essential to (1) establish the technology for scaling to the high brightness levels required for the applications; (2) explore technology options to reduce the size and weight of laser weapon systems, minimizing the impact upon the weapon system platform, and (3) investigate technology concepts to significantly improve potential system reliability and reduce acquisition time and costs. This PE concentrates on those aspects of technology with high payoff for Air Force specific applications. The efforts contained in this program do not duplicate any tasks being conducted under the Strategic Defense Initiative (SDI).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	46,680	12,399	37,146		Continuing	N/A

For FY 1984 this program existed as a single project, 317J. During FY 1985 it was divided into three projects. For FY 1985 Congress reduced the funding to $5 million, this canceled the planned oxygen-iodine scaleup. It delayed upgrades to facilites for visible wavelength lasers, as well as several optical component technology efforts. It also eliminated support for the deuterium fluoride (DF) chemical laser to be used for effects testing. For FY 1986 the number of visible wavelength chemical laser concepts under study has been reduced from four to two. Several optical component technology investigations have been postponed to FY 1987. For FY 1986 the Phased Integrated Laser/Optics Technology program will transition from PE 62601F, Advanced Weapons.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Military Construction: Funds	0	0	0	1,081	N/A	N/A

5. (U) RELATED ACTIVITIES: This program element is part of the tactical directed energy weapon program coordinated by the Director for Military Systems Technology in the office of the Under Secretary of Defense for Research and Engineering. This includes work in Air Force PE 62601F project 3326, Laser Applications, and Army PE 62307A, Laser Weapon Technology. Coordination with the Navy Directed Energy office is also included. This PE is extensively coordinated with the Strategic Defense Initiatives Program PE 63221D, Directed Energy Weapons. PE 63605F closely follows all applicable work in PE 63221D and makes appropriate use of all technology with tactical applications. Coordination with the Department of Energy is through the laboratory technical program reviews, exchange of technical reports, and cooperative efforts at the working level.

6. (U) WORK PERFORMED BY: The Air Force Weapons Laboratory (AFWL), Kirtland Air Force Base NM, manages this program. The top five contractors were: Rockwell Rocketdyne, Canoga Park CA; TRW, Redondo Beach CA; General Dynamics, Fort Worth TX; Hughes Aircraft, Culver City CA; and BDM, McLean VA. There were 14 additional contractors with contracts totaling $4.5 million in FY 84. In-house test facilities include the Advanced Radiation Technology Facility at Kirtland Air Force Base NM.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 3150, Laser Device Technology. This project is new for FY 1986, however, it was a separate thrust under project 317J. The objective of this project is to develop technology for high efficiency, visible wavelength high energy laser devices which are scalable to high brightness levels. The requirement for high brightness leads to the consideration of shorter wavelength laser beams which can be focused to smaller spot sizes on target. High efficiency is also important, since this is directly related to the size and weight of the laser system at a given performance level. These characteristics are paramount for small, efficient Air Force high energy lasers.

For these reasons, primary emphasis is placed on developing the technology and demonstrating the feasibility of visible wavelength chemical laser concepts. For the most promising concepts emerging from exploratory development, this project will carry the concepts from the initial lasing feasibility experiments through lasing demonstrations in the 10-20 kW range to verify the first step in scalability to high power. In the development of infrared chemical lasers the integration of the gain generator and resonator of a cylindrical deuterium fluoride (DF) chemical laser was completed in December 1984. The integration and testing of this device is the culmination of a seven-year development effort to establish the technology needed to scale DF chemical lasers at minimum size and weight. The laser device will produce about [ ] of laser power with good beam quality; this testing will be the first demonstration of a chemical laser with scalable cylindrical geometry. In addition to demonstrating the cylindrical laser concept at high power, this testing provides diagnostic data and validated modeling/analysis capabilities for the evaluation and further development of future cylindrical laser devices. In early FY 1985 an oxygen-iodine chemical laser generated 4 kW with supersonic flow. This demonstration provided the first experimental data for the evaluation of the efficiency and scalability of the oxygen-iodine chemical laser to high power. The technology to operate the oxygen-iodine laser at a visible wavelength will transition from PE 62601F, Advanced Weapons. One of a number of new promising visible chemical laser concepts, based on excited nitrogen and iodine monofluoride, will also transition from PE 62601F if gain is demonstrated in FY 1985. Hardware for both visible wavelength lasers will be developed in this project during FY 1986 and FY 1987. Lasing feasibility demonstrations will occur at the kilowatt scale by early FY 1988. These visible wavelength chemical lasers offer significant promise for tactical applications because of their moderate size and high efficiency.

B. (U) Project: 3152, Technology Development Support. This project is new for FY 1986, however, it was a separate thrust under project 317J. This project supports the other two projects within this program element in generic areas and establishes and operates special experimental facilities. This project provides advanced laser diagnostic instrumentation, conducts laser performance analyses, and provides laser structural analysis techniques. Support objectives include: providing an in-house capability to investigate advanced mirror finishing techniques and optical coating technologies; providing an in-house capability for high power testing of optical components; and providing a capability for laser effects and vulnerability experiments with a moderate power DF laser. Efforts within this project will emphasize the upgrade of existing support capabilities to improve accuracy and applicability to technology and applications of current interest. Efforts in diagnostic instrumentation development, laser performance analysis, structural analysis, optical facilities operation, and laser test facility development were conducted in FY 1984 in support of the entire program. In completing the fabrication of the annular resonator optics for the high power cylindrical DF chemical laser, the final polishing of the optical surface was accomplished in the Air Force Weapons Laboratory in-house optical facilities. New polishing techniques were developed for the annular shapes and the stringent optical surface quality requirements were successfully met. In the development of a laser facility for high energy laser effects testing, a deuterium fluoride chemical laser has been installed, and supporting facility activation was completed in FY 1984. Laser testing and characterization was started, with the completion of activation testing planned for early FY 1985. The upgrade of the optical facilities, begun in FY 1984, will continue to provide a capability for fabrication and evaluation of optical components at visible wavelengths. Laser performance analysis will also continue, to provide estimates of overall system performance and guidance for technology development efforts. In structural

analysis, work will continue in FY 1986 to develop and upgrade computer codes to analyze structural distortion and vibration of laser subsystems. Work will begin in FY 1986 on the upgrade of structural analysis capability for optical structures. Laser performance analysis will also continue in support of technology development efforts.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3151, Optics and Beam Control Technology

A. (U) Project Description: This project is new for FY 1986, however, it was a separate thrust under project 317J. The overall objective of this project is to develop technology in advanced beam control concepts, optical components, and optical resonators to achieve the high brightness levels and the reliability required for Air Force high energy laser applications. To achieve this, this project will develop the small optics and beam control technology required for moderate sized visible wavelength lasers. In the advanced beam control concepts area, the primary objectives are to demonstrate the feasibility of phased array concepts for obtaining large effective apertures from small mirrors, the feasibility of advanced tactical sized adaptive optics concepts for achieving the high resolution, high bandwidth compensation for optical disturbances required at visible wavelengths, and the feasibility of advanced, integrated laser/optics technology for use in high power applications. Secondary objectives include developing higher accuracy tracking sensors, improved beam path stabilization concepts, and higher bandwidth beam steering mirrors to support the advanced beam control design concept. In the optical components area, the primary objective is to establish the feasibility of advanced cooled mirror concepts which offer the lower distortions required for visible wavelength lasers. These generic advanced cooled mirror concepts will support pulsed as well as continuous wave visible wavelength lasers. Optical components for these short wavelength lasers must be significantly improved over current technology. In the optical resonator technology area, the principal objective is to investigate novel resonators for low gain media such as visible wavelength chemical lasers.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: (Applicable portion of Project 317J.) Significant progress was made in the development and demonstration of concepts for phased array beam control. In laboratory experiments, three independent four-inch telescopes were successfully phased together dynamically to within one twentieth of a wavelength in the visible. This experiment was vitally important as a preliminary demonstration of the feasibility of phased arrays, in which a single large aperture beam control system can be synthesized from a number of separate, smaller apertures. A series of flight tests were conducted to gather data for the evaluation of the effects of an aerodynamic flow field on the propagation of laser beams. In these tests, extensive data were taken both on the properties of the flow field and on the aerooptical effects themselves. These tests provide full-scale data under actual flight conditions, used for direct estimates of aerooptical effects and a baseline for comparison with smaller-scale test results from wind tunnel experiments and computer modeling. In another effort, the fabrication of the annular optics for the high power cylindrical deuterium fluoride laser was successfully completed. The fabrication of these optical components was particularly difficult because of the annular shapes, coupled with the stringent accuracy requirement and high

power loading. After diamond turning of the mirror surface, the components were polished to the final optical tolerances and dielectric coatings were added to reach the high reflectivity required. The final coating processes were completed successfully in May 1984 and the optical components were delivered for integration with the laser gain generator. The fabrication technology developed during this effort will have great benefits for all future high energy lasers.

(2) (U) FY 1985 Program: (Applicable portion of Project 317J.) The investigation of concepts for phased array beam control in analysis and laboratory testing will continue, with emphasis on demonstrating the feasibility of target tracking and compensating for misalignment effects. Phased array technology may be the key to the feasibility of optical apertures required for tactical applications. Advanced beam control and optical component concepts will be investigated through analysis and the development and testing of laboratory breadboards; efforts are planned in improved optical components, advanced electrooptical concepts for adaptive optics applications, and improved resonator configurations. These efforts are required for future visible wavelength chemical lasers.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Development of the technology base for visible wavelength high energy lasers will continue. Efforts will investigate advanced, high-payoff concepts and components for Air Force missions. Phased array beam control investigations will continue in analysis and laboratory testing to evaluate the basic feasibility and performance of phased array concepts. This work will focus on acquisition and rapid retargeting for Air Force applications. Beam control optical component technology development will continue; advanced concepts will be investigated in laboratory breadboards; and beginning in FY 1986, promising concepts will be scaled to full-scale components for performance evaluation. In FY 1986, a major effort will also be initiated, following transition from PE 62601F, Advanced Weapons, for the investigation of the Phased Integrated Laser/Optics Technology (PILOT) concept. The PILOT concept is a recent technology

The basic PILOT concept was developed in-house within the Air Force during FY 1984, with its genesis in the investigation of the technology base for supported by both PE 62601F and PE 63605F. The PILOT concept is

During FY 1986, efforts will begin for the development of the PILOT concept, leading to a demonstration of feasibility for Efforts are also planned in conventional and nonlinear adaptive optics, resonator concepts, and resonator phase-locking techniques. In parallel with component technology investgation, planning will begin for an experiment to combine advanced component technologies in a laboratory breadboard to demonstrate their payoff in an integrated laser and beam control system design. Cost estimates for the efforts within this project are based on previous government experience with similar work and on government engineering judgment for beam control component development, integration, and testing. Cost estimate category IV.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Phased Array Laboratory Tracking Experiments	June 1985
(2)		PILOT	
(3)	(U)	Beam Control Component Breadboard Demonstrations	September 1987
(4)		PILOT Concept Feasibility Demonstration	
(5)	(U)	Advanced Beam Control Breadboard	September 1990

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63704F Title: Manpower and Personnel Systems Technology
DOD Mission Area: #522 - Environmental and Life Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		796	2,039	2,199	2,407	Continuing	N/A
2922	Personnel Assessment Systems	500	1,238	1,300	1,300	Continuing	N/A
2948	Occupational Analysis Technology	170	91	100	100	Continuing	N/A
2949	Basic Skills Assessment and Enhancement System	0	360	529	757	2,127	3,773
2951	Training Decisions System	126	350	270	250	930	1,926

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a Science and Technology Program which provides advanced technology development to select, classify, train and assign qualified individuals to Air Force jobs, and to satisfy DOD and Congressional requirements for all Services to validate selection methods using job performace measurements. The Air Force has a critical need for improved manpower and personnel management systems to effectively and efficiently provide a continuing supply of quality men and women for Air Force jobs. Increasingly complex weapon systems, force composition and training demands, and diminishing numbers of qualified recruits require that the Air Force develop systems that insure the most effective and efficient use of manpower and personnel resources.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	796	2,039	2,247		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Related PEs are 62703F, Personnel Utilization Technology; 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; 62717A, Human Performance Effectiveness and Simulation; 63731A, Manpower and Personnel; 62763N, Personnel and Training Technology; and 63707N, Manpower Control System Development.

6. (U) WORK PERFORMED BY: Florida International University Research, Miami, FL (2922); McDonnell Douglas, St Louis, MO (2951); the Maxima Corp, Bethesda, MD (2949, 2922, 2948). The program element will be managed by the Air Force Human Resources Laboratory (AFHRL), Brooks AFB, TX, through the Manpower and Personnel Division.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2922, Personnel Assessment Systems. To meet increasing requirements for Air Force combat capability, readiness, and sustainability, a constant input of capable manpower is needed. The technology to identify, select, train, and assign individuals capable of mastering complex technical skills must be developed and demonstrated. This technology must include the development of new systems which would provide information currently unavailable on individual job performance. As directed by Congress, technology to measure on-the-job performance will be developed to validate selection and classification tests and assess training outcomes. Procedures for measuring task-level job performance will be provided to HQ USAF for use by trained evaluators across Air Force specialties. The Air Force is the DOD Executive Agent for the Armed Services Vocational Aptitude Battery (ASVAB) which is used by all the Services for selection and classification of enlisted members. This test battery must be routinely revised and replaced to avoid obsolescence, guard against compromise and incorporate improvements identified in the ongoing Services test research programs. In FY 1985, a prototype job performance measurement system for one Air Force enlisted specialty will be completed, evaluated, and field tested. Development of additional enlisted specialty measures and modification of the measurement for use with officer specialties will begin. As performance measures and state-of-the-art testing developments, such as computerized adaptive testing, become available from 6.2 research, they will be transitioned to the development of new enlisted and officer performance measurement prototypes. Also, validation of the high school version of the Armed Services Vocational Aptitude Battery (ASVAB) will be initiated to provide data for counseling of high school seniors as potential recruits for the Armed Services. During FY 1986, development and revision of the enlisted and officer job performance measurement technologies will continue, and the technology will be expanded to include civilian specialties. Also, continuing during FY 1986 will be development of new prototypes for both the enlisted and officer selection test batteries. Work in enlisted classification in computer adaptive testing and rated officer selection work on computer-based tests will be used to explore possible computer-based/computer-adaptive officer selection and classification.

B. (U) Project: 2948, Occupational Analysis Technology. The Comprehensive Occupational Data Analysis Programs (CODAP) system is the primary operational Air Force occupational analysis tool. The CODAP system has resulted in cost avoidance of over $3 million per year since its implementation in FY 1968, but has become antiquated and difficult to maintain. An advanced development program is required to provide a top-down, structured approach to system redesign and reprogramming to make it more efficient, easier to maintain, and more user-friendly. Benefits include: (1) state-of-the-art analytical, statistical, and reporting procedures, (2) techniques for longitudinal analyses of job content, (3) techniques for developing more job-related promotion tests, (4) techniques for matching weapon system acquisition tasks with related personnel skill requirements, and (5) critical task analysis techniques for job performance measurement and basic skills assessment. In FY 1984, development began on improved software capability

including organization of various analytical and statistical programs into a common job analytic system. The improved user-friendly software system will be completed in FY 1985. In FY 1986, the development of a prototype occupational measurement system will begin with advanced task and job clustering capabilities and automated job typing procedures.

C. (U) Project: 2949, Basic Skills Assessment and Enhancement System. This project will start in FY 1985 and will provide a system to measure and train the basic functional and enabling skills (literacy, arithmetic computation, dial and map reading, etc.) required in Air Force enlisted specialties. Since the basic skills requirements for Air Force occupational specialties have not been derived, the relationship between basic abilities and Air Force on-the-job performance cannot be established. This project will: (1) validate basic functional occupational requirements against job performance measures, (2) develop and validate basic ability measures specific to occupational requirements, (3) develop training packages to correct job-specific skill deficiencies, and (4) develop a basic skills technology management information system for tracking and managing the system across all occupational specialties in the Air Force. Initial building of instructional modules for identified job prerequisites will begin in FY 1985. Development of initial specifications for evaluation of training effectiveness to be validated against job performance will also be initiated in FY 1985, as will the development of comprehensive implementation plans. In FY 1986, the development of training modules for 120 Air Force specialties will be initiated and specifications for training effectiveness evaluation and validation will be completed. Comprehensive training implementation plans will also be completed and plans for developing instructional modules will begin. Upon completion, products from this project will reduce the numbers of marginal performers, reduce overall on-the-job training time, result in increased numbers of career airmen, and provide airmen with the skills necessary to perform well on the job immediately upon initial assignment. Savings from reduced attrition and increased productivity could reach as much as $10 million per year.

D. (U) Project: 2951, Training Decisions System. A critical need exists for a more unified, practical, and integrated approach with all relevant data considered at once for certain training management decisions. In FY 1984, a system definition package containing detailed specifications of major users, system flexibility, and hardware requirements was developed. In FY 1985, initial specifications for the advanced Training Decisions System (TDS) will be developed, as well as technical functions of the operating subsystems. Task grouping methods, consisting of computerized techniques for clustering specialty job tasks into skill and knowledge groupings, will be developed in FY 1986. These groupings, called "Task Training Modules" are composed of blocks of tasks that can reasonably be trained together as instructional units and will be used in decisions on allocating training content to different settings (resident schools and field units). Other future milestones include the transfer of computer technology to user organizations, field tests and system refinements with applications in four Air Force specialties, and definition of manning, resources, and pipeline schedules needed for sustained operations. Benefits from this project will include reduced training costs, improved allocations of training content and resources, demonstrably better alignment of training content with job task requirements, and reduced training workload on operational Air Force units. When operational, projected total savings plus cost avoidance are on the order of $20 million per year, at a minimum.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63707F Title: Weather Systems
DOD Mission Area: #420 - Global Military Environmental Support Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,433	2,955	3,963	3,754	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element funds three advanced development efforts. (1) Battlefield Weather Observation and Forecast System (BWOFS): The Air Force critically needs the ability to observe and collect essential weather information in battle areas not under friendly control. Employment of precision guided munitions requires specific environmental information which is unique to the weapon's sensing systems and which is not available through present weather observing and forecasting techniques. This program develops methods to gather this vital weather information and process it for use by battle staff planners/aircrews in the effective employment of conventional and precision guided munitions on the battlefield; it provides a key to optimizing force effectiveness during adverse weather conditions; (2) Algorithm Development for Next Generation Weather Radar (NEXRAD): This work supports the development of a doppler weather radar capability. Timely warning for specific severe weather events is required to protect Air Force assets. Doppler weather radar provides the ability to detect severe weather phenomena. Automated analysis techniques are required to process this information in a timely manner to provide effective warning. This program provides the required automatic radar data analysis techniques to the joint Department of Defense/Department of Transportation/Department of Commerce NEXRAD Development; (3) Automated Weather Distribution System Automated Observation Subsystem (AWDS-AOS): The Air Force has a need to automatically sense, collect, disseminate, and display the local weather conditions in real time to air traffic control facilities and operational units. Several key weather elements, particularly current weather, and cloud bases above 1,000 feet can not be automatically sensed with current technology. This program develops the technology to automatically sense these critical weather parameters. When fielded this program will reduce weather support manpower requirements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	3,212	2,955	2,460		Continuing	N/A

EXPLANATION: (U) FY 1986 funds were transferred from AWDS-AOS effort in The Weather Systems PE 64707F to this PE when studies revealed additional advanced development was required before the program could enter full scale development.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Results of advanced development efforts in this Program Element are implemented through Program Element 64707F, Weather Systems (Engineering Development) and Program Element 35111F, Weather Service (Other Procurement). Specifically, results of the Battlefield Weather Observation and Forecast System (BWOFS) will undergo engineering development in PE 64707F. Next Generation Weather Radar (NEXRAD) development (PE 64707F) will directly use automated severe weather forecast techniques developed in this program element. The FY 1984 Science and Technology Program Review to the Under Secretary of Defense for Research and Engineering provided a forum for tri-service coordination of efforts in battlefield forecasting techniques. Working level contact with the Army and Navy continues, avoiding unnecessary parallel development of techniques and systems.

6. (U) WORK PERFORMED BY: BWOFS and Automated Weather Distribution System Automated Observation Subsystem (AWDS-AOS) program management is provided by Air Force Geophysics Laboratory (AFGL), Hanscom AFB, MA, with program participation by Air Force Wright Aeronautical Laboratories, Wright Patterson AFB, OH and Air Force Armament Laboratory, Eglin AFB, FL. Principal contractors are Systems and Applied Science Corporation, Riverdale, MD; Battelle Columbus Laboratories, Columbus, OH, Georgia Institute of Technology, Atlanta, GA; and Analytics, Willow Grove, PA. All NEXRAD work is performed in house at AFGL.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 63707F, Weather Systems (Advanced Development)

A. (U) Project Description: BWOFS: Develops the ability to acquire and process weather information for use by battle commanders and pilots to employ precision guided munitions effectively. The Air Force has no capability to gather or process environmental information from denied areas, yet this information is critical to the effectiveness of today's high technology weapons. Algorithm Development for NEXRAD: Develops a set of doppler weather radar diagnostic algorithms for the automated and early detection and warning of severe storm related wind and precipitation related threats to Air Force operations and facilities. These techniques will meet the operational requirements of the forthcoming system. AWDS-AOS: Develops the capability to automatically sense present weather conditions, visibility and cloud bases above 10,000 feet.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: BWOFS: Hand-held calculator versions of Tactical Decision Aids for TV and laser designator systems were fielded. Development of research grade Tactical Decision Aids for millimeter wave systems began. An unmanned vehicle was selected as the platform to obtain critical weather data from enemy controlled areas. Algorithm Development for NEXRAD: An experimental doppler weather radar at the Air Force Geophysics Laboratory was used to test and evaluate new algorithms for improving severe weather warnings in the northeast United States. The test was highly successful; it demonstrated numerous minor algorithm deficiencies that will be corrected prior to fielding the system. AWDS-AOS: Feasibility of a prototype present weather detector was determined.

(2) (U) FY 1985 Program: Battlefield Weather Observation and Forecast System (BWOFS): Weather sensors to satisfy requirements of tactical employment data will be tested. Development of operational tactical decision aids for other laser systems will be completed. Development of operational Tactical Decision Aids for millimeter wave systems will begin. Algorithm Development for the Next Generation Weather Radar (NEXRAD): Development of automated techniques for identification and forecast of gust fronts and aircraft icing regimes will be accomplished in 1985. Algorithms and associated documentation and test results will be provided to the NEXRAD Joint Program Office for incorporation into the NEXRAD prototype analysis system. Automated Weather Distribution System Automated Observation Subsystem (AWDS-AOS): The present weather algorithm will be refined. The impact of adding additional measured weather parameters to the present weather algorithm will be determined.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: BWOFS: Calculator versions of the Carbon Dioxide (CO_2) laser radar and millimeter wave systems Tactical Decision Aids (TDA) will be provided to Air Weather Service for operational use. Work will begin on a research grade of the computer based composite TDA. The composite TDA will combine all TDAs into one package to facilitate multi-weapons systems employment planning. Prototype sensor testing will be completed for the weather observatory system and integration on the unmanned vehicle will begin. Algorithm Development for NEXRAD: Preplanned algorithm improvements will be developed to improve detection and analysis of tornadoes, hail and tropical cyclones. AWDS-AOS: Initial development work will begin to achieve an automated capability to sense visibility and cloud bases above 10,000 feet.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	BWOFS	Program initiation	1980
(2)	(U)	NEXRAD	Program initiation	October 1980
(3)	(U)	BWOFS	Infrared Tactical Decision Aid (TDA) Operational	1983
(4)	(U)	BWOFS	Development of TV and 1.06 micron laser TDAs Complete	June 1984
(5)	(U)	NEXRAD	Northeast United States Test complete	June 1984
(6)	(U)	BWOFS	Observation subsystem sensors testing complete	1985
(7)	(U)	NEXRAD	Algorithms delivered to Joint Program Office	1985
(8)	(U)	AWDS-AOS	Begin development of automated visibility and cloud base sensors	October 1985
(9)	(U)	BWOFS	Observation subsystem testing complete	1986
(10)	(U)	NEXRAD	Initial Operational Capability including algorithms	1988

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63718F
DOD Mission Area: #374 - C^3 Protection/Multimission, Technology, & Support

Title: Electronic Warfare Technology
Budget Activity: #2 - Advanced Technology

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		20,136	22,105	29,436	36,901	Continuing	N/A
691X	Electronic Warfare Technology	11,136	12,305	15,559	19,295	Continuing	N/A
2432	Warning and Power Management Systems Technology	6,900	7,700	11,677	15,006	Continuing	N/A
2754	C^3 Countermeasures Technology	2,100	2,100	2,200	2,600	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced development in the area of electronic warfare where an expanded technology base is needed to solve critical penetration aid problems for all classes of manned and unmanned aircraft. The Soviets currently employ some form of radar in each of their surface-to-air and air-to-air weapons system surveillance, tracking, pointing and guidance. Their use of radar is continuing at an ever increasing rate. Ongoing and planned major technology thrusts to counter the growing radio frequency threat includes signature reduction in support of low observable technology, advanced Electronic Warfare (EW) transmitters, receivers, advanced power management, and command, control, and communication countermeasures. This program also provides for component, technique and subsystems development leading to the reduction of acquisition and life cycle cost of electronic warfare equipment and systems.

3. COMPARISON WITH FY 1985 Descriptive Summary: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	20,136	22,105	25,683		Continuing	N/A

FY 1986 Difference: The $3.8 million increase in FY 1986 is for the initiation of technology development.

4.) OTHER APPROPRIATION FUNDS: Not Applicable.

5. RELATED ACTIVITIES: The efforts in this program are closely coordinated with Program Element (PE) 63743F, Electro-Optical Warfare and other electro-optical and electronic warfare programs as well as advanced development work in similar activities by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group and memoranda of agreement. Exploratory development efforts are phased into this program from PE 62204F, Aerospace Avionics. Completed electronic warfare efforts are transitioned into the engineering development programs: PE 64220F, Electronic Warfare (EW) Counter Response; PE 64710F, Reconnaissance Equipment; PE 64724F, Tactical Command, Control Communication (C^3) Countermeasures; PE 64738F, Protective Systems; PE 64737F, Airborne Self Protection Jammer; and PE 64739F, Tactical Protective Systems. Tri-Service efforts are in [ ] warning receivers and jamming systems, and [ ] Joint Air Force/Navy efforts are in an Advanced Transmitter applicable to the ALQ-99 installed in the EF-111A, EA-6B, and expendable countermeasure decoys. A joint program with the Navy has been established in the Integrated Electronic Warfare System (INEWS). Project 2754 develops C^3 countermeasures technology; advanced planning, architecture, and overall guidance will be performed in PE 63749F, C^3 Countermeasures Advanced Systems, Project 2947, Advanced C^3 Countermeasures.

6. (U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the program. The Rome Air Development Center, Griffiss AFB, NY, manages two tasks in Project 2754, C^3 Countermeasures. The major contractors are: CALSPAN, Buffalo, NY (691X); Raytheon, Goleta, CA, (691X, 2754); Georgia Institute of Technology Research Institute, Atlanta, GA (691X); United Technologies, Norwalk, CT, (691X); and SEDCO Corporation, Farmingdale, NY, (691X). There are 14 additional active contractors with a total contract face value of $12,546 thousand.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

A. Project: 2754, C^3 Countermeasures Technology. The purpose of this project is to consolidate C^3 countermeasures efforts previously conducted in Project 691X and new efforts designed to disrupt enemy C^3 systems. Major thrusts include: Airborne jamming and deception techniques; drone-borne and expendable C^3 countermeasures; analysis, simulator and evaluation support; location and identification of C^3 nodes and links; and ground based voice and signal deception. In order to accomplish their assigned missions and improve aircraft survivability, the Tactical Air Forces (TAF), Strategic Air Command (SAC) and Electronic Security Command (ESC) require a combined air and ground capability to degrade selected enemy communication links and nets. Included are methods to identify critical enemy communications links, integrate this information into the signals intelligence network, and display the enemy battlefield communication scenario. These countermeasures enable tactical and strategic aircraft to disrupt enemy ground control intercepts and prevent effective use of Surface-to-Air Missile (SAM) and AntiAircraft Artillery (AAA) defenses. User requirements are documented in TAF General Operational Requirement (GOR) 301-78, ESC Statement of Need (SONs) 1-80 and 3-80, and SAC Required Operational Capability (ROC) 23-69. The C^3 jammer brassboard system was completed in FY 1984. Simulator testing was conducted to determine expected effectiveness in a suitably dense signal environment characteristic of actual combat. A mini-drone jammer targeted against [ ] was tested with good results. A technology demonstration was also conducted

via flight tests against simulated [ ] complexes at Nellis AFB flight test ranges. A new development effort was initiated for a software and display capability to [ ] for planning, control and execution of C^3 countermeasures. Algorithm definition and design will be completed and the system will be configured in FY 1985. In addition, the C^3 jammer pod modules were test flown. The processing/display for [ ] efforts were started in FY 1984. In FY 85 we will continue efforts for C^3 Jammer, Mini-Drone jammer technology demonstration, Real-Time Electromagnetic Digitally Controlled Analyser and Processor (REDCAP) simulation improvements, target recognition schemes and [ ] New starts will include C^3 countermeasures transmitter modules development, deception jammer experiment, low band C^3 countermeasures jammer, [ ] jammer, C^3 countermeasures payload studies and [ ] In FY 1986 we will continue Mini-Drone jammer flight testing, target recognition schemes, [ ] COMPASS CALL support efforts, C^3 counter measure transmitter, and strategic link jammer. New starts will include [ ] development, [ ] receiver, C^3 countermeasures analysis and decision aids.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 691X, Electronic Warfare Technology

A. (U) Project Description: (U) The purpose of Project 691X is to provide advanced development of new countermeasure techniques and hardware for both existing and new electronic warfare systems. The project includes the following areas: (1) a supporting simulation effort that guides the allocation of funding through the evaluation of new concepts and techniques; (2) radar signature reduction to delay and impair acquisition and tracking of our aircraft by enemy radar; (3) on-board jamming systems, components, and techniques needed to jam enemy radar; (4) off-board or expendable systems to confuse enemy radars and dilute enemy defenses; (5) electronic collection systems to inform the field commander of changes in the electronic environment; and (6) the development of standardized and low cost reliable and maintainable components and systems to enable the Department of Defense to better afford the increasing amount and sophistication of electronic countermeasures equipment required on modern aircraft. The enemy air defense network is characterized by both airborne and land based radar and communication systems that locate, monitor, guide, and control offensive and defensive elements. The enemy continues to improve these elements against our forces and our operational countermeasures. This requires a strong technology base to provide demonstrated counters to these improvement and avoid technological surprises by new enemy threat systems. This project is a technology base effort which supports Tactical Air Command (TAC) Statement of Need (SON) 315-73, 301-78, and 304-80; Strategic Air Command (SAC) SONs 23-69, 13-73, 3-79, 6-81, and 10-81; and Military Airlift Command (MAC) SONs 7-81, 8-81, and 9-81.

Program Element: #63718F
DOD Mission Area: #374 - Multimission, Technology, & Support

Title: Electronic Warfare Programs
Budget Activity: #2 - Advanced Technology

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: The survivability issue was investigated through analyses and digital engagement simulations that define needed Electronic Warfare (EW) capabilities such as warning, missile avoidance, and countermeasures. A primary application will be the wherein a special investigation is examining the warning system output needed to avoid missile attack through maneuvers. The initial phase of the program was completed. A 36 month program was initiated. Investigation of technology continued. The program that will flight test new experimental chaff units to evaluate manufacturing techniques and performance against a representative threat radar was continued. The Cross Trak and Sabre Cross Countermeasures systems were flight tested against radars that included These tests evaluated performance against radar modes. In addition, testing evaluated The 30 month technology risk reduction effort was started for a capability that will adapt the This will serve as a precursor to a specialized capability. An 18-month effort was started to develop a that will provide technology support to development. A 24-month Reliability and Maintainability (R&M) effort, entitled Pathfinder, was started to analyze equipment and component type failures and technical weaknesses. A 40-month Power Supply Reliability Improvement program was started to upgrade the Standard Radio Frequency (RF) Chain amplifier system. The Processor design was finalized.

(2) FY 1985 Program: Complete tri-service warning, jamming and chaff efforts, AF/Navy high power transmitter, flight test Cross Trak/Sabre Cross techonology, design. Continue radar signature reduction, surveillance radar jamming, advanced radar signal high speed recognizer effort, ECM simulation and evaluation. Initiate new joint AF/Navy/Army expendable, jamming techniques against threat solid state jammers for stand-off and self-protection, development of a lower cost high reliability Continue hardware developments, development, new cross eye technique, countermeasure risk reduction, terrain reflectivity measurements, reliability and maintainabilty EW study, countermeasure, Traveling Wave Tube (TWT) effort, brassboard and Military Airlift Command (MAC) EW suite development.

(3) FY 1986 Program and Basis for FY 1986 RDT&E Request: Continued development efforts include ECM simulation and modeling, of antennas and EW subsystems, technology, improved chaff/expendables, joint AF/Navy/Army expendables, jamming techniques against threat an improved for stand-off aircraft (EF-111A), a lower cost, highly reliable jammer, monolithic receivers/transmitters, development,

countermeasure risk reduction, terrain reflectivity measurements, reliability and maintainability EW study, TWT improvement effort, high Effective Radiated Power Jammers, MAC EW, and Based on the results of a technology study, additional efforts will be started for systems. Candidates for increased emphasis include antennas, digital Radio Frequency (RF) memories, components, countermeasures, and expendable decoys.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2432, Warning and Power Management Systems Technology

A. Project Description: The purpose of Project 2432 is to develop warning and power management technologies to cope with the projected threat environments both for strategic and tactical aircraft. The project includes the following areas: 1) advanced power management systems to develop and evaluate optimum system configurations, 2) high speed, flexible jamming signal generators, 3) radar signal receiver technologies that are smaller, can handle dense signal environments, and are able to 4) high speed signal processors that can sort through data and determine optimum jamming response, and 5) receive and transmit antennas which can provide precise threat direction and unambiguous warning to aircrews. The enemy air defense network relies on radar systems to search, acquire, target, and guide missiles and antiaircraft fire. Because of this proliferation of different radar systems in large numbers, and over a large portion of the microwave frequencies, sophisticated systems are required to analyze the threat environment and either warn aircrew of potential threats or initiate an automatic jamming response. Literally, will impinge on the aircraft and require extensive sorting to and determine an optimum use of the limited on-board jamming resources through power management. This project is a technology base effort. User requirements are documented in Tactical Air Forces (TAF) Statement of Need (SONs) 304-80, 315-73 and Strategic Air Command (SAC) Required Operational Capability (ROC) 3-79.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Five parallel Phase 1A Integrated Electronic Warfare System (INEWS) Concept Definition Investigation contracts were awarded to identify the detailed performance requirements and optimum system concepts for a multispectrum EW suite. INEWS planning and schedule have been developed to support its timely integration into the Advanced Tactical Fighter and Advanced Tactical Aircraft. Integration activities are being coordinated through the Advanced System Avionics (Pave Pillar) program. The Advanced Power Management System baselining was initiated. The High Density Environment Simulator improvement program was continued.

Program Element: 63718F | Title: Electronic Warfare Technology
DOD Mission Area: #374 - Multimission, Technology, & Support | Budget Activity: #2 - Advanced Technology

(2) FY 1985 Program: The Advanced Power Management System (APMS) will complete baselining and will be integrated into the Dynamic Electromagnetic Environment Simulator (DEES) facility for use as a "Hot Bench" for power management experiments; High Density Environment Simulator(HIDES) will be finished and delivered to the DEES for testing. Advanced signal processor studies will be completed and antenna will be delivered. Continue APMS "Hot Bench" testing and experimentation, coherent Radio Frequency (RF) exciter development, frequency synthesizer Reliability and Maintainability (R&M), developments and Integrated Electronic Warfare System (INEWS) Concept Definition Investigation (CDI) Phase 1A studies. Intiate RF front end integration with DoD High Order Language (Ada) Measurement system, testing of receiver brassboard, Electronic Warfare (EW) software analysis and time-difference-of-arrival measurement demonstration.

(3) FY 1986 Program and Basis for FY 1986 RDT&E Request: Development efforts that will continue include APMS "Hot Bench" experimentation, HIDES integration with DEES, advanced radar receivers and signal processors, angle-of-arrival Electronic Countermeasures (ECM) power management concepts, and developments. INEWS risk reduction, (Phase I B) will be initiated. Contractor teams will be required to design, fabricate integrate, test and deliver risk reduction hardware. An INEWS system design refinement effort will also be initiated. Other new starts will include multispectral development frequency synthesizer integration, testing high speed Very High Speed Integrated Circuit (VHSIC) signal processors and analog optical signal processors. Continue receiver effort and higher order language EW software anlaysis and time-difference-of-arrival measurement efforts. Based on the results of a technology study, additional efforts will be started for EW systems.

(4) (U) Program to Completion: This is a continuing program.

C. Major Milestones: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63723F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Civil and Environmental Engineering Technology
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6,585	9,100	11,488	17,321	Continuing	N/A
2103	Environmental Quality Technology	700	534	3,650	3,773	Continuing	N/A
2104	Civil Engineering Technology	3,378	4,466	4,726	4,712	Continuing	N/A
2672	Special Terrestrial Power	307	200	300	500	Continuing	N/A
3037	Noise and Sonic Boom Impact Technology		900	912	2,736	5,652	10,200
3139	Alaskan Remote Site Fuel Cell	2,200	3,000	1,900	5,600	13,300	26,000

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides technology base to enhance force readiness and improve sortie generation capability. This goal is achieved by efforts to: develop an improved post attack launch and recovery capability; provide technology for more effective tactical deployment, air mobility, and survivable air base structures; optimize airfield surface maintenance, repair, and new construction techniques; develop more effective fire fighting agents, equipment, and vehicles; provide technology for characterization, control, and disposal of Air Force unique pollutants such that Federal, Department of Defense, State, and local environmental regulations are met; develop an aircraft noise assessment and prediction capability so that environmental impacts caused by subsonic and supersonic aircraft can be evaluated; and adapt Department of Energy and other agencies' technology to enhance the survivability and reduce the vulnerability and petroleum-fuel dependence of mission essential energy systems. This program is part of the Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,385	17,247	11,716		Continuing	N/A

The difference between the funding shown in the FY 1985 descriptive summary and the FY 1986 descriptive summary reflects a number of program changes. For the FY 1985 program, the reduction reflects a one year delay in the Congressionally directed Alaskan/Remote Site Fuel Cell effort and an additional Congressional action which removed $6.2 million in Defense Environmental Restoration Program (DERP) funds from the program element and placed them in a central account. Development of criteria for using recycled Portland cement concrete as an aggregate to reduce airfield pavement costs and development of the capability to monitor and predict the migration and fate of the Space Shuttle exhaust ground cloud will also be delayed.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands). Not applicable.

5. (U) RELATED ACTIVITIES: The efforts within this program are of significant interest to the other services and are specifically coordinated through the Joint Services Civil Engineering Research and Development Coordinating Group, which is responsive to the Department of Defense. This group ensures efforts are not duplicated across the services and that maximum technology transfer is obtained. In addition, the group has an airbase survivability panel which reviews post attack launch and recovery efforts. All Air Force efforts in environmental quality R&D are covered in the Department of Defense Environmental Quality Area Coordinating Paper which is specifically designed to prevent duplication within the military services and between the services and other agencies. For sonic boom issues, the Air Force has been designated lead service. Efforts of civilian or national interest are coordinated as appropriate with the Federal Aviation Administration, National Aeronautics and Space Administration, Environmental Protection Agency, and Department of Energy; and joint programs have been established with those agencies. The Air Force and the Navy have a memorandum of agreement to conduct joint programs in the area of aircraft fire suppression and crash rescue. This program directly funds some efforts that eventually transition into Program Element 64708F, Other Operational Equipment, and Program Element 64617, Air Base Survivability. Additionally Program Element 62601F, Advanced Weapons, funds exploratory development in environmental quality (Project 1900) and Civil Engineering Technology (Project 2673). Projects 1900 and 2673 will make up Program Element 62206F, Civil Engineering and Environmental Quality beginning in FY 1986. Program Element 62203F, Aerospace Propulsion, funds exploratory development in power generation and energy conversion technology, and Program Element 62202F, Aerospace Biotechnology, funds exploratory development of technology to determine human effects of aircraft noise and sonic boom.

6. (U) WORK PERFORMED BY: In-house efforts are conducted by the Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base, FL; Aero Propulsion Laboratory, Wright-Patterson AFB, OH; and Aerospace Medical Division's Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH. These laboratory facilities provide the capability for: subscale and limited full-scale protective construction and weapons effects testing, design and testing of airfield pavement materials and construction techniques, computer facility and utility design analysis, environmental chemistry research, and test and evaluation of power generation and energy conversion technology. The resources of other government agencies are also used. These include the Departments of the Army, Navy and Energy, the National Bureau of Standards, the Bureau of Mines, Brookhaven National Laboratory, Oak Ridge National Laboratory, the Environmental Protection Agency, the National Aeronautics and Space Administration, the U.S. Geological Survey, and the Federal Aviation Administration. The top five contractors and associated projects are BDM Corporation, McLean, VA (2104); United Technologies, Power Systems Division, South Windsor, CN (3139); New Mexico Engineering Research Institute, Albuquerque, NM (2104); University of Florida, Gainesville, FL (2103); and CENTEC Corporation, Reston, VA (2103). The total number of other contractors is 5 with a total additional contract dollar value of $370,000.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2103, Environmental Quality. Provides for the advanced development of technology for addressing

Air Force unique and time critical problems in environmental quality. The goal is to ensure compliance with environmental regulations so that readiness is maintained by allowing full deployment of new weapon systems and realistic, unimpeded peacetime training and operations. This project tests and evaluates evolving pollution control technologies for their effectiveness in solving problems of environmental restoration, weapon systems emissions and toxic pollutant releases from Air Force operations. This program is required to provide the technology base to support the Air Force civil and bioenvironmental engineers in meeting Air Force requirements such as those in Strategic Air Command Statement of Operational Need (SON) 4-82, Groundwater Pollution Abatement, Air Force Logistics Command SON 1-82, Reducing the Quantity of Hazardous Wastes, and Space Division Technical Need 5-82, Remote Sensing of the Shuttle Exhaust Ground Cloud. The following are brief descriptions of FY 1984 accomplishments. Development of a sampling and analysis methodology for the identification of individual hydrocarbon species in jet turbine engine exhausts was successfully completed. These procedures contributed to achieving a 98 percent carbon balance identification which allowed an accurate identification of those components which are photochemically reactive. The air quality assessment model (AQAM) was transferred to the Occupational and Environmental Health Laboratory (OEHL) and is now an operational model used to assess air quality on and around Air Force bases. Pilot plant testing of biological treatment of phenolic paintstripping wastewater was successfully completed. This testing indicated up to a 99 percent removal of phenols at high concentrations (1500 milligrams per liter) in presence of high levels of toxic metals. The following are brief descriptions of planned work for FY 1985. In support of future Space Shuttle launches from Vandenburg AFB, CA, research efforts to develop methods and instruments for monitoring hydrogen chloride (HCl) will be continued in FY 1985. Included in the shuttle-related research program are efforts to develop passive monitors for the far-field HCl deposition, real-time monitors for the near field, and laser remote sensors to map and measure the launch ground cloud. New research to be initiated in FY 1985 will focus on developing accurate particulate measuring devices for use on turbine engine and test cell exhaust. In the area of environmental modeling, work will begin on a heavy gas dispersion model and on an aircraft engine exhaust plume dynamics model. The FY 1986 planned program will consist primarily of a continuation of research begun in FY 1984 and FY 1985, much of which will extend into and beyond FY 1987. Included in those continuing efforts are further development of the laser remote sensing system for use in monitoring pollutant and toxic materials and the particulate emissions measurement devices for use on turbine engines and test cell emissions. The field demonstrations in support of the Defense Environmental Restoration Program (DERP), initiated in FY 1985 with funds from the central Defense Environmental Restoration Account, will be completed with successful technologies being transferred to DERP managers and planners. Additional site demonstrations for groundwater and soil clean-up will be initiated to more fully investigate the effectiveness and controlling parameters of chemical degradation of dioxin, enhanced microbial degradation of chlorinated solvents, and physical/chemical methods to remove volatile organic contaminates from humidified air streams resulting from groundwater decontamination methods which use airstripping. Research to be completed in FY 1986 includes: development of hydrogen chloride monitoring equipment and models for predicting the dispersion of heavy gases (particularly nitrogen tetroxide) and for predicting the movement of aircraft exhaust plumes. Research will be initiated on methods to control test cell emission and techniques to measure pollutant distribution behind gas turbine engines.

B. (U) Project: 2104, Civil Engineering Technology. Provides technology for survivable air base structures, assurance of sortie generation and reduction of airfield maintenance and repair costs. In FY 1985 and FY 1986 the

bulk of this project is devoted to the rapid runway repair (RRR) program, which is developing the technology for an air base to resume flying operations within hours after attack versus the current capability of days. The RRR program specifically addresses Tactical Air Forces Statement of Operational Need 319-79, Post Attack Launch and Recovery. During FY 1984, the performance specifications for an advanced polymer concrete material were finalized and the material was used in the structural cap (polycap) repair method, which was successfully tested on an exploded crater with aircraft 20 minutes after placement. Fully mechanized repair capability, which reduces manpower requirements and chemical/biological manpower performance degradation and enhances repair time, was investigated. Full scale prototype crater repair equipment was designed and built. Also, as part of the continued development of low-cost alternate launch and recovery surfaces, subbase designs were evaluated for performance under freeze/thaw conditions and development of rapidly installed taxiways continued. Damage-resistant runway technology was also investigated. Analysis of foreign object damage (FOD) effects on aircraft operations on repaired airfields was conducted, and the initial testing of an asphalt concrete design suitable for the heavyweight F-15 was conducted. The functional area damage assessment program identified and prioritized those air base functional areas critical to combat sortie generation rates and conducted vulnerability assessments for ten critical assets on Spangdahlem Air Base. This effort highlighted some of the current deficiencies in accurately predicting degradation of sortie generation rates due to functional area damage and has provided valuable insight into developing better methodology for sortie generation assessment. The airfield pavements program has concentrated on closing pavement recycling technology gaps to extend highway pavement recycling technology to airfield pavements required to support very high aircraft wheel loads and tire pressures. The practical composition of asphalts can now be determined with accuracy and repeatability as a result of FY 1984 efforts. This allows isolation of those chemical constituents which must be blended back into the old oxidized asphalt to restore flexibility and adhesive properties. A test method founded on Air Force work is now being prepared by the American Society for Testing and Materials, and when published, will be widely used by the paving industry. The following are brief descriptions of planned work for FY 1985. The rapid runway repair program will develop a computer model for the KC-135 surface roughness evaluations and determine its critical components. Efforts will continue towards the development of the fully mechanized polycap repair system. Analysis will be conducted to determine the application of robotics technology to runway repair. The vulnerability of aircraft engines and tires to FOD will be investigated. Testing of the heavyweight F-15 on asphalt concrete pavements will be completed. Portable radioluminescent lighting for night operations from battle-damaged and bare base airfields will be developed. Full scale testing of hypar (hyperbolic paraboloid) shell structures will demonstrate the efficiency of this unconventional geometric structure and fill an Air Force need of having an economical structural facility that is lightweight, easily transported, fabricated and erected, yet is strong enough to withstand near-miss detonations of conventional bombs. The rock rubble overlay and burster slab concept of the protective antipenetration system will be finalized. Work will continue in developing recycling technology unique to AF use in rehabilitating badly deteriorated airfield pavements. Preliminary procedures will be established for selecting an asphalt recycling agent. Candidate methods for determining when to remove rubber deposits from pavements and a method of evaluating contractor performance when removing rubber will be developed. The fire research efforts will be directed in several areas: installed equipment and systems; three dimensional agents; and new concept fire-fighting vehicles. FY 1986 will mark the completion of advanced development efforts for the RRR program. Technology required to complete the transition of the fully mechanized polycap repair systems will be finalized. Studies and analyses of test data related to FOD clearing requirements will continue to completion. The development of ultra-strength concrete (30,000 psi compressive

strength) using dynamic compaction techniques will be exploited to produce various sizes and shapes of structural members to enable this impressive new material to be used for rock rubble/burster slab (antipenetration systems), blast energy panels, bomb-damage resistant runways, and a myriad of applications. The development of a lightweight armor protection system for tactical shelters for protection from the effects of conventional weapons will continue. Development of criteria for recycling of rigid pavements will begin. Studies of the effect on pavements of ultra-high aircraft tire pressures and wheel loads will be initiated. Initial formulations of a three-dimensional fire suppressant agent and concept designs of the new concept firefighting vehicle will continue. New efforts are projected to begin the development of a fire response data system and a robotic fire sentry for aircraft.

C. (U) Project: 2672, Special Terrestrial Power. Adapts Department of Energy (DOE) and Army developed fuel cell electric power plant and advanced heat engine technology to meet Air Force remote, auxiliary, unattended, and special power system needs. Fuel cells and heat engines use half the fuel of conventional diesel and gasoline generators; however, the technology needs to be advanced in order to meet the Air Force unique requirements. Current thrusts: (1) In a joint Air Force/Army effort, develops and demonstrates multifuel 3 kilowatt (kw) free-piston Stirling engine (FPSE) systems for mobile applications. The Air Force funded portion supplements the Army's advanced development program and will demonstrate logistic multifuel FPSE generator sets in FY 1986. (2) Development and demonstration of a 3kw FPSE linear alternator set is an evolutionary technology advancement and responds to a need for improved tactical power sources for tactical air control parties (TACP) and combat control teams (CCT). TACP and CCT power requirements for communications and navigation equipment are currently met with gasoline generators and batteries which are old, unreliable, bulky, heavy, and well behind the present state-of-the-art. Also, the generators emit significant infrared signatures. The FPSE linear alternator offers reduced infrared signatures. Two FPSE systems will be tested under the joint Air Force/ Army program. Demonstrated operation, performance, reliability and life cycle cost data will be distributed to the major air commands. The following are brief descriptions of FY 1984 accomplishments. A brassboard 5kw phosphoric acid fuel cell which runs on neat methanol was completed. Field testing of the unit configured for field use will be accomplished in FY 1985. A 40kw fuel cell power plant (natural gas fuel) was installed at the Air Force Museum at Wright-Patterson Air Force Base. This is part of the national DOE 40kw fuel cell test program. A jointly funded program with the Army to develop a multifuel FPSE was established. Two systems will be developed: a high efficiency system (Mechanical Technology, Inc.) and a high reliability, low weight and small size system (Sunpower, Inc.). The following are brief descriptions of planned work for FY 1985. Data gathering on the 5kw and 40kw fuel cell power plant will be completed and information will be disseminated to the major air commands. A multifuel combustor for the FPSE will be developed and evaluated, FPSE systems designs will be completed and critical components will be developed. In FY 1986 the multifuel FPSE power systems development and hardware fabrication will be completed and field testing will begin. The Air Force field test is expected to be conducted with the Tactical Air Command. Inhouse planning for the development of a 60kw Stirling engine power system for USAF tactical applications will be conducted with development beginning in FY 1987.

D. (U) Project: 3037, Noise and Sonic Boom Impact Technology. Develops an aircraft noise assessment and prediction capability so that the environmental impact of subsonic and supersonic aircraft can be evaluated. Without this capability, use of vital airspace has been constrained due to the lack of scientific methods to predict the effects of noise on particular environments. Specific tasks are listed in USAF Statement of Operational Need (SON) 1-81,

Noise and Sonic Boom Description and Analysis, and relate to providing the Air Force with techniques and data to use in working with the Environmental Protection Agency, states and local communities to establish use of airspace under the National Environmental Policy Act. Fulfillment of the need is critical to mitigate effects of aircraft noise, prepare convincing environmental impact statements, and respond to litigations brought against the USAF. This project started in FY 1985. In FY 1985 a design study will develop a detailed technical program plan describing the immediate and long range technical approach and specific efforts required to address USAF SON 1-81 needs including: measurement/monitoring technology, models to predict exposure, human response/health effects, animal effects and structural effects of noise and booms. Efforts will also be initiated in FY 1985 to procure monitoring exposure equipment and software to analyze currently available data to aid future modeling efforts. FY 1986 begins the majority of the program thrust. Specifically, a study to determine the effects of noise and sonic booms on humans and their health, as well as these same effects on structures, will be initiated and will conclude in FY 1989 and 1988 respectively. A third effort will develop a noise model which will allow description of anticipated subsonic and supersonic noise activities as required in the environmental impact analysis process. Continuing development of the noise monitor software is required (completion FY 1987) to complete the model program.

E. (U) Project: 3139, Alaskan/Remote Site Fuel Cell. Develops, tests and evaluates 60-120 kilowatt (kw) phosphoric acid fuel cell (PAFC) power plant for USAF remote site applications. Develops critical technology, including operations on USAF logistic fuels, to allow military application of fuel cell power plants. Uses operational and design data from the Department of Energy 40kw field test presently underway. The primary technology issue is a fuel processor to permit fuel cell operation on USAF logistic fuels. Fuel processor integration into power plants without reducing overall power plant efficiency is critical. Power plant will meet military standards and operate in harsh environments. This evolutionary technology is an alternative solution to high fuel costs in remote sites where fuel transportation cost may be several times fuel acquisition cost. Fuel costs will be reduced due to the 40 percent efficiency of fuel cell power plants compared to the 20-30 percent efficiency of diesel generator sets currently used. Prototype power plants will be field tested and evaluated in USAF remote site applications. Demonstrated operation, performance, reliability and life cycle cost data will be distributed to major commands. Field tests will be conducted with target customers to initiate the technology transition dialogue. This project responds to Congressional direction given in both the FY 1983 and FY 1984 Senate Appropriations Committee reports on the DOD appropriations bills. In FY 84 a memorandum of understanding between the Air Force and the Army provides that the Belvoir Research and Development Center (Army) will provide technical support for the program. Arrangements were made with the Department of Energy and the National Aeronautics and Space Administration to obtain a 40kw fuel cell and field maintenance support for initial data gathering in Alaska. The Elmendorf AFB, AK base power plant was selected as the test site. In FY 1985 the test of the 40kw fuel cell power plant in Alaska will be completed and development of the logistics fuels processor and extreme environmental capability features will begin. Development of the logistic fuels processor and the extreme environmental condition features are planned to be completed in FY 1986 and factored into the power plant design. A contract will be established for the power plant design and development in FY 1986.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63726F
DOD Mission Area: #225-Air Warfare Support

Title: Fiber Optics Development
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,702	3,053	3,861	3,885	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The mobile elements of the Tactical Air Control System (TACS) must be capable of separating their associated operations centers apart from radio frequency (RF) emitters to maximize survivability and operational flexibility. Also, the weight, cost and bulk restrictions of present interconnecting cable systems cause significant degradation to the mobility and flexibility of tactical systems. Fiber optics have been demonstrated to provide substantial increases in remoting distances for RF emitters with greatly reduced weight and cost. A further benefit is the reduction in bulk of the extensive cabling associated with TACS elements. This program provides the advance development fiber optics systems designed to meet these requirements. Also included is the definition of standards to provide interoperability between Air Force systems and the systems of the other Services and to prevent the proliferation of non-standard equipment.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,702	3,053	3,946		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: The efforts in this program element include transition of technology developed under PE 62702F, Command, Control, and Communications. Efforts within the Air Force are coordinated by the Air Force Fiber Optics Working Group. Coordination between the Services is through the Tri-Service Fiber Optic Coordinating Group.

6. (U) WORK PERFORMED BY: The Air Force Systems Command manages this program through the Rome Air Development Center, Griffiss AFB, NY. The current contractors are: GTE Sylvania, Needham, MA, Tactical Generic Cable Replacement (TGCR) and Standard Family of Transceivers; TRW, El Segundo, CA (TGCR); ITT, Roanoke, VA and Nutley, NJ, Single Fiber Transmisson; and RCA, Camden, NJ, Standard Family of Transceivers.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 63726F, Fiber Optics Development

PE #: 63726F

Program Element: # 63726F — Title: Fiber Optics Development
DOD Mission Area: #225 Air Warfare Support — Budget Activity: #4 - Tactical Programs

A. (U) Project Description: The most effective means of providing a remoting capability for the Tactical Air Command and Control System (TACCS) and reducing the weight and bulk of the cable is to convert the 26-pair cable to fiber optics. The development of a Tactical Generic Cable Replacement (TGCR) will make this possible and is the highest priority task in this program. Additional benefits will be achieved through reduction in the number of optical fibers required - Single Fiber Optical Transmission System, development of fiber Local Area Net (LAN) multiplexers, and a Radar Remoting Applique to achieve full remoting capability for current radars. The Standard Family of Transceivers will allow standard equipment for engineers to use in their system design. Lastly, Tactical Intrusion Resistant Optical Cable (IROC) will allow transmission of classified data without the complications of crypto equipment.

B. (U) Program Accomplishments and Future Efforts

(1) (U) FY 1984 Accomplishments: A brassboard model of the Tactical Generic Cable Replacement (TGCR) equipment was demonstrated. Design was completed for the Single Fiber Optical Transmission System and a family of standard transceivers.

(2) (U) FY 1985 Program: Fabrication will begin on an advance development model TGCR, standard family transceivers and the Single Fiber System. The Single Fiber Optical Transmission System will have a field demonstration. Development will start on a Tactical IROC System, family of standard LAN multiplexers, and a Radar Remote Applique Unit.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Fabrication of advance development model TGCR and a family of transceivers will be completed and will proceed to field demonstration. Design will be completed on the family of LAN multiplexers, and will continue on the Tactical IROC and the Radar Remoting Applique Unit.

(4) (U) Program to Completion: This is a continuing Program.

C. (U) Major Milestones:

Milestones	Date
(1) (U) Single Fiber Demonstration Complete	June 1985
(2) (U) TGCR Demonstration Completed	November 1985
(3) (U) Family of Transceivers Fabrication Complete	July 1986
(4) (U) Family of Transceivers Demonstration Complete	December 1986

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63727F
DOD Mission Area: #345 - Tactical Communications

Title: Advanced Communications Technology
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,824	4,838	4,895	4,711	Continuing	N/A
2345	Airborne Imagery Transmission	2,196	2,800	3,231	2,700	Continuing	N/A
2746	Low Probability of Intercept Comm	848	1,000	744	900	Continuing	N/A
2747	Communication Vulnerability Analysis	587	740	734	738	Continuing	N/A
2748	Advanced High Frequency Technology	193	298	186	373	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Modern military systems and weapons derive much of their value from the communication systems which provide the primary means of force coordination and battle management.

This program provides continuing research and development of new communication technologies to offset this threat evolution and to insure viable communications during the 1980s and 1990s. Specific emphasis is being placed on the development of: a jam resistant reconnaissance data link for penetrating, low altitude reconnaissance vehicles; low probability of intercept tactical communications; analysis of the vulnerability of command, control and communication (C^3) systems; and advanced high frequency communication technology.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	3,824	4,338	5,003		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This program is part of a coordinated effort to improve communication capabilities. As such, it is related to Command, Control and Communications, PE 62702F; Command, Control and Communication Advanced Development PE 63789F; and Advanced Communication Systems, PE 27423F. Advanced data link technology efforts will develop an advanced, wideband jam-resistant data link for real and near-real time reconnaissance efforts in Reconnaisance

Sensors/Processing Technology, PE 63208F; and Tactical Surveillance, Reconnaissance, and Target Acquisition, PE 64710F. Data link development tasks are coordinated with the Army Modular Integrated Communication Navigation System (MICNS), PE 64748A.

6. (U) WORK PERFORMED BY: Air Force Systems Command (AFSC), Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson AFB, OH and Rome Air Development Center (RADC), Griffiss AFB, NY. Contractors (with applicable project numbers) include: Sperry Univac Corporation, Salt Lake City, UT (2345); Magnavox Data Systems, Falls Church, VA (2747); ITT Avionics Division, Nutley, NJ (2746, 2748); Boeing Aerospace Company, Seattle, WA (2746); Georgia Institute of Technology, Atlanta, GA (2345, 2746); MITRE Corporation, Bedford, MA (2747).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2345, Airborne Imagery Transmission (ABIT). This project will provide the advanced data link technology required to counter the Soviet threat during the late 1980s and after.

program emphasis will be placed on antenna nulling and beam forming, information compression, wide band and extremely wide bandwidth spread spectrum modems, focal plane technology and data link evaluation technologies. These modular techniques will be developed within an architecture that will allow a modular employment and enhancement as new technologies and threats arise. This project emphasizes reconnaissance applications, particularly air-to-air links. Additional efforts include characterization of previously developed multibeam antenna array (Lincoln Laboratory) and an assessment of its capability for use in this program.

(U) FY 1984 accomplishments in this project were as follows: completed threat assessment and vulnerability analysis of ABIT; completed two competing design concept studies; initiated design/development/fabrication of a brassboard modular, air-to-air data link; continued actions to purchase an air-to-ground data link; completed development of software for use in the Reconnaissance Modem Evaluation Facility; and continued ABIT test planning. FY 1985 efforts include: continuing design/development/fabrication of the brassboard air-to-air data link; completing acquisition and initiating flight test of the air-to-ground data link; and continuing test planning for future flight tests. The FY 1986 planned program includes: continuation of design/development/fabrication of the brassboard air-to-air data link and completion of flight test of the air-to-ground data link.

B. Project: 2746, Low Probability of Intercept (LPI) Communication. Present and future Air Force tactical plans require the use of stealth in the penetration, execution, and withdrawal phases of various missions. This requirement was established by the need to reduce the effectiveness of the ever-increasing number of sophisticated hostile threats.

This program will provide the jam resistant LPI communication system technology necessary to reduce the physical vulnerability of airborne platforms to detection, location and subsequent destruction through exploitation of radio signals. This technology program will augment other low

observables avionics programs by ensuring that communication emanations are not the "weak link" to negate the effectiveness of stealth vehicles.

The Air Force has ongoing programs to develop an anti-jam (AJ) communication capability (e.g., Joint Tactical Information Distribution System (JTIDS), and Enhanced JTIDS System. These future spread spectrum radio waveforms will provide some Low Probability of Intercept (LPI) capability; however, the high transmission power requirement to achieve an AJ capability is not consistent with the need for reduced avionics and communications observables. This project was created to address this need and at the same time support Tactical Air Forces (TAF) Required Operational Capability (ROC) 321-75, Jam-Resistant Secure Voice Communication.

(U) FY 1984 accomplishments in this project were as follows: initiated LPI technology evaluation efforts, including development of an LPI radio system concept design and evaluation of the effectiveness of various emerging LPI techniques; initiated efforts to provide a conceptual design of an Electronic Support Measure (ESM) intercept receiver to detect, characterize, and track spread spectrum signals and to determine vulnerability of various spread spectrum waveforms to detection and characterization; initiated the HAVE LACE effort to demonstrate feasibility of laser communications between airborne platforms; and continued test planning for all future tests. FY 1985 efforts include: continuing LPI technology assessment, ESM design, and vulnerability assessment efforts begun in FY 1984; conducting ground and airborne tests of HAVE LACE laser communications; and continuing test planning for future testing. The FY 1986 planned program includes: completion of LPI technology assessment, ESM design, and vulnerability assessment efforts; initiation of development/fabrication of a multi-mode LPI communication terminal brassboard to demonstrate the feasibility of integrating multiple LPI communication techniques; and continuation of test planning.

C. Project: 2747, Communication Vulnerability Analysis (CVA). As a result of a deployed Soviet command, control and communication (C^3) countermeasure threat, the Air Force is investing heavily in Electronic Counter-Countermeasure (ECCM) systems. At the same time, Soviet Electronic Countermeasure (ECM) technology continues to evolve.

The Air Force needs to consolidate this expertise and develop a comprehensive methodology for vulnerabilities analysis and testing of communication systems, including large, netted C^3 systems. This project was created to address this need. The CVA project will consolidate the technical efforts and expertise in communication vulnerability analysis, and will develop, test, and evaluate a comprehensive methodology and special test equipment for assessing the vulnerability of developmental C^3 technology, equipment, and systems to detection, deception, exploitation and jamming. This program will give the Air Force an evaluation tool that can be applied to advanced communication systems during their development, thereby reducing costly "after the fact" system modifications and greatly increasing the degree of confidence of decision makers in approving systems for further development and production.

(U) FY 1984 accomplishments in this project were as follows: completed consolidation of vulnerability definition and threat data base; continued development of CVA techniques; continued effort to define special test equipment requirements for a CVA test bed; and continued to participate in development of methodology for vulnerability assessment

of microwave line-of-sight and tropo scatter links and anti-jam communication systems - e.g., HAVE QUICK and Enhanced JTIDS System (EJS). FY 1985 efforts include: completing definition of a comprehensive Communications Vulnerability Analysis (CVA) methodology; continuing definition of test bed requirements and beginning acquisition of test equipment; and continuing to support vulnerability assessments/studies of other systems. The FY 1986 planned program includes: completion of integration of threat data and environments; completion of definition of CVA test bed; continuation of acquisition of special test equipment; beginning integration of methodologies, simulations, and test equipment into a comprehensive CVA facility; and continuation of support for vulnerability assessment efforts in other programs.

D. Project: 2748, Advanced High Frequency Technology. Traditionally, the High Frequency (HF) radio has been used as a primary means of long range communications by military forces. However, in past years, its use has been de-emphasized because of its susceptibility to jamming, nuclear effects, and natural ionospheric disturbances. Coupled with this has been the increased emphasis on the use of satellite systems to provide worldwide communications.

Consequently, the Air Force requires reliable alternative communication systems to satellite systems. Both Military Airlift Command (MAC) and Strategic Air Command (SAC) have stated requirements for this improved capability (SAC ROC 5-77, MAC GOR 3-77).

Advanced capability Electronic Counter-Countermeasures modules will be developed that may be applied to future HF radio enhancements.

(U) In FY 1984 this project continued development/fabrication of narrowband HF modules, focusing on voice source encoding over narrowband HF channels, adaptive channel equalization, adaptive signal processing, and frequency hopping. FY 1985 efforts include continuing development/fabrication of narrowband HF modules and planning for future testing. The FY 1986 planned program for this project includes: completing fabrication of narrowband HF modules; initiating development/fabrication of a frequency hopping coupler; and continuing test planning.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63728F
DOD Mission Area: #551 - Electronics and Physical Science (ATD)

Title: Advanced Computer Technology
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR	PROGRAM ELEMENT	6,858	6,672	8,643	10,651	Continuing	N/A
2527	Software Life Cycle Tools	545	1,241	1,895	2,500	Continuing	N/A
2529	Computer Architecture Applications	766	900	720	1,330	Continuing	N/A
2530	Distributed System Technology	2,608	3,031	3,078	4,561	Continuing	N/A
2532	High Order Language Discipline	2,939	1,500	2,950	2,260	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops and demonstrates technologies to improve the processes of developing and modifying military computer software in order to control cost, reduce risk, and increase efficiency and effectiveness. Thrusts include development of the Ada Integrated Environment (AIE), automating the software development process, introducing standards as appropriate, and providing management support tools. This program also exploits advances in distributed processing technology for improved system fault tolerance, reliability, and survivability, and provides for initial technology insertion activities for potential standard programming languages, tools, and architectures. Finally, it provides the focal point for continued investigation of applications of Artificial Intelligence (AI) to Air Force systems. This is a Science and Technology Program.

3. (U) COMPARISON FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,858	6,672	6,983		Continuing	N/A

- The FY 1986 funding increase of $1850 thousand over the FY 1985 descriptive summary is directed at work in Projects 2527 and 2532. Project 2527 has been increased by $700 thousand to support the application of AI technology to the development of "smart" software maintenance tools. Project 2532 has been increased by $1650 thousand to allow the completion of the Minimal Ada Program Support Environment (MAPSE) under the Ada Integrated Environment (AIE)

contract with Intermetrics Inc. of Cambridge, Massachusetts. The Ada Integrated Environment (AIE) contract had been descoped in FY 1983 due to cost growth which effectively stopped all work on Minimum Ada Program Support Environment (MAPSE) tools. The additional funds will support restarting and completing of the MAPSE tool set. As the MAPSE is a formal requirement of the Air Force Ada introduction plan, it is important that it be completed to facilitate the expeditious transition of the Ada programming language into the operational Air Force.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Not applicable.

5. (U) RELATED ACTIVITIES: This program supports and is responsive to the DOD Defense Computer Technology Plan and the DOD-sponsored Software Technology Initiative entitled Software Technology for Adaptable, Reliable Systems (STARS). Interfaces are maintained with other programs that constitute the DOD Software Science and Technology Program. The specific technical areas supported by these other programs include computer and information sciences, tactical automation, distributed information systems, computer resource management, and computer applications to command, control, and communications. An interface has been established with the Software Engineering Institute activity which represents one vehicle for transitioning software technology to the operational Air Force. Coordination with other Services is continual and is accomplished through the STARS Joint Program Office, DOD Apportionment Reviews, and the Ada Joint Program Office.

6. (U) WORK PERFORMED BY: The Rome Air Development Center (RADC), Griffiss AFB NY, has management responsibility for this program. The top five contractors are: Intermetrics, Cambridge MA; Bolt, Baranek, and Newman, Cambridge MA; Honeywell, Minneapolis MN; Control Data Corporation, Minneapolis MN; and System Development Corporation, Santa Monica CA. There are/will be 11 additional contractors for a FY 1986 total funding of $8.833 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2527, Software Life Cycle Tools. The objective of this project is to develop and demonstrate software engineering technology in the areas of specifications, design, development, and maintenance and to transfer developed products into the Air Force acquisition environment. FY 1984 Accomplishments - Efforts were completed that resulted in the delivery of a Software Test Guidebook in the development of an automated path testbed and in the demonstration of software reliability models. In addition, the development of a software quality requirements guidebook was completed. Efforts were initiated to enhance and apply software quality measurement tools to Command, Control, Communications, and Intelligence (C^3I) systems and to implement a software requirements specification tool. FY 1985 Program - Efforts are planned to initiate the development of rapid prototyping techniques for C^3I systems and to design and develop a methodology-independent workstation to assist in the specification of software requirements and designs. FY 1986 Planned Program - New start and continuation activities for implementations under this project scheduled for FY 1986 will consist of individual efforts in the areas of the Command, Control, Communication and

Intelligence (C^3I) Software Environment, System Definition Technology, and Software and System Quality. In the Environment area, the development of a C^3I Support Environment based on a PE 62702F/5581 Definition contract with General Research Corporation will be initiated. This will provide a baseline capability on a VAX 11/780/VMS computer system for continued development and ultimate transfer to Electronic Systems Division's Software Center Of Excellence. An initial version of a common user interface, common database structure, and nominal tool set will be constructed and demonstrated. Under System Definition Technology, the implementation of a C^3I Rapid Prototyping capability to provide for closer user ties to the software life cycle development process will continue. In addition, the improvement program for the Requirements Specification Tool effort begun in FY 1984 will continue. There are two major activities planned for the Software and System Quality area for FY 1986. The demonstration and validation of software quality measurements and instrumentation of the C^3I Support Environment described above to automatically collect software metric data will continue. Both of these efforts will begin in FY 1985. All of the above efforts are within the present Project fund profile/ceiling and are in the main stream of a 6.2, 6.3, 6.4 technology plan for the Rome Air Development Center (RADC) software engineering technology base program. Cost of the FY 1986 program is based upon budgetary cost estimates (category III).

B. (U) Project: 2529, Computer Architecture Applications. The objective of Project 2529 is to evaluate standardized commercial and Department of Defense (DOD) developed computer architectures to determine their applicability and efficiency in Air Force C^3I applications. Results of these evaluations are documented in technical reports and in Air Force and Air Force Systems Command regulations. Developed a brassboard model of Nebula architecture machine applications for evaluation in the context of Air Force (AF) C^3I The evaluation of Nebula Architecture within the context of Rome Air Development Center (RADC) Common Control Element (CCE) Development began. Modular Control Element (MCE) functions and enhancements were retargeted to Nebula from the Navy standard AN/UYK-14 processor. Nebula inefficiencies and the architectural features required to support the Air Force 32-bit command and control mission were identified for the next planned revision to MIL-STD-1862. Verification of the existing standard was accomplished by executing recommended Army software. FY 1985 Program - During 1984-1985, Nebula peripherals, interface and Nebula support software will be added to support the C^3I Nebula evaluation effort. MCE software in the areas of tracking and weapons assignment will be coded and debugged first using the Nebula simulator, and the Brassboard following its delivery. Other MCE software which is core of the CCE will be coded for Nebula evaluation. This software will then be used as will the Nebula to effect advanced concepts in command and control and thus provide a framework for evaluating Nebula in the context of Advanced AF C^3I systems. The evaluation of the Nebula Instruction Set Architecture (ISA), started in FY 1985, will continue through FY 1986 and will be fully supported by a complement of peripheral devices and an operating system. The programs providing this support were initiated under Project 2529 in FY 1984. The capability of the Instruction Set Architecture (ISA) to support the execution of computer programs coded in Ada will start producing useful inputs into the overall evaluation. The only new start for FY 1986 will address the potential of advanced computer architecture for Command, Control, Communications and Intelligence (C^3I) based on Reduced Instruction Set Computer (RISC). FY 1986 Planned Program - The evaluation of the Nebula ISA, started

in FY 1985, will continue through FY 1986 and will be fully supported by a complement of peripheral devices and an operating system. The programs providing this support were initiated under Project 2529 in FY 1984. Another FY 1985 start, Nebula ISA Feature Enhancements, is designed to keep the AF current with respect to potential upgrades which will provide improved performance for implementation of the ISA and a wider range of ISA operational applicability in AF integrated systems. The only new start for FY 1986 will address the potential of advanced computer architectures for C^3I based on RISC concepts. Cost of the FY 1986 program is based on planning estimates (category IV) for the Nebula Feature Enhancement and RISC work and on budgetary estimates (category III) for all other work.

C. (U) Project: 2530, Distributed System Technology. The objective of Project 2530 is to develop, demonstrate and evaluate techniques and tools to provide distributed data processing systems. These systems can be configured around local cluster configurations or span large geographic areas. Their key attribute is to provide a cohesive processing environment composed of the integrated resource set which can support survivability through reconfiguration in the event of lost components or nodes. FY 1984 Accomplishments - Development continued on a distributed operating system, which represents a major advance in the state-of-the-art and integrates multiple heterogeneous computers on a local area network. The system incorporates survivability mechanisms which will guarantee data integrity at the various nodes. In addition, mechanisms are being included in the design to facilitate the addition of new host computers as well as rehosting onto a different local area network. Enhanced reliability and fault tolerance mechanisms were developed under the Recovery Mechanisms Effort to facilitate error detection, isolation, correction, and system roll back. These mechanisms will be incorporated into the operating system structure at a later date. Alternative designs to provide security within a database management system were investigated, and a taxonomy was developed. A version of the system was hosted at Rome Air Development Center (RADC), and an internetted dual cluster configuration was designed. This test capability allowed us to evaluate the distributed operating system structure as well as demonstrate multi-node distributed applications. Transition of generic database technology was carried out in the areas of database reconstitution and control element database structures. These efforts demonstrated the capability to re-establish database integrity for a distributed database configuration which has been fragmented. Additional issues of real time update for target database and the application of database machine architectures were pursued. FY 1985 Program - Decentralized system control strategies will be demonstrated. This will provide the basis for developing distributed systems resource sharing wherein multiple nodes can cooperate on complex processing problems and reconfigure the system load distribution in the event of a failure at one or more of the nodes. This will be accomplished by demonstrating the ability to migrate tasks and data automatically to alternate nodes when anomalous system behavior is detected. The ultimate goal will be to demonstrate survivability of a distributed system configuration application to both strategic and tactical command and control systems. FY 1986 Planned Program - During FY 1986, new starts and continuation efforts will be pursued with the emphasis on Distributed Operating Systems and Resource Control, Survivability and Reconstitution Techniques for Distributed Systems and Prototype Demonstrations to support transition. In the Disributed Operating System (DOS) area, the single cluster Cronus DOS will be extended to a dual cluster to allow investigation of the internetting issues which occur when multiple local clusters are interconnected by a long distance network. This would be similar to the environment anticipated when multiple command centers are

interconnected. Data movement, synchronization, and protocols will be major technical thrusts. Enhanced methods of resource control will be investigated to support the concepts of survivability and reconstitution. One of the potential attributes of distributed systems is the ability to survive the loss of nodes or links by reconfiguring the system. This allows data and programs to be moved to remaining nodes to assure continuance of mission critical functions. New concepts in adaptive control and fault tolerance offer potential for supporting these capabilities dynamically. This will become critical as consideration of spaceborne Command and Control (C^2) systems operating in conjunction with ground and airborne systems is begun. Prototype demonstrations of the technology products within this project will continue to be provided, particularly within the context of the new Battle Management Laboratory at Rome Air Development Center. This will provide an environment within which the products such as the DOS and Distributed Database can be demonstrated and evaluated, as well as a development for the newer adaptive control mechanisms. All of the above efforts are within present project funds. However, they are being started at a very low level and could be accelerated with additional funds. All of the efforts are in the main stream of the 6.2, 6.3, and 6.4 critical technology program at Rome Air Development Center in Distributed Systems. Cost of the FY 1986 program is based on budgetary estimates category III).

D. (U) Project: 2532, High Order Language Discipline. This project develops High Order Languages (HOLs), compilers and associated tools required to develop Air Force software in an efficient, cost effective manner. The project has two thrusts. The first is the development of compilers and an integrated programming environment to support Air Force introduction of Ada. The second is the development of HOLs and tools to support rapid cost effective development of Artificial Intelligence (AI) based systems. FY 1984 Accomplishments - The first milestone in the development of the Ada Integrated Environment (AIE), the bootstrap Ada compiler (written in Pascal), was completed. The bootstrap compiler is being used to complete development of a production quality Ada compiler hosted and targeted on the IBM 4341 computer. Implementation of a programming environment based on logical/list processing language (LOGLISP), to support development of artificial intelligence based systems was initiated. FY 1985 Program - The Ada compiler for the IBM 4341 will be completed. Development of the AIE will continue with the implementation of the database, debugger and editor components of the system. Detailed designs for the LOGLISP environment will be completed. FY 1986 Planned Program- In FY 1986 development of the AIE (excluding the Ada IBM 4341 compiler completed in FY 1985) will continue. This includes a data base system to support software development, and project and configuration management; an Ada oriented text editor; and source level debugger. Completion of the AIE is anticipated in FY 1987. The development of the LOGLISP programming environment will also continue in FY86. Two new starts are anticipated in FY 1986. The first is for development of an Ada compiler for the MIL-STD-1750A computer. The compiler will be hosted on an IBM 4341 and targeted to the MIL-STD-1750A computer. The second new start is for the development of a testing system for Ada software. The tool will incorporate both testing, code auditing, symbolic evaluation, task monitoring and other techniques and thus provide a comprehensive testing capability for Ada. Cost of the FY 1986 program is based on planning estimates (category IV) for the Ada testing system and budgetary estimates (category III) for all other work.

8. PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 63743F   Title: Electro-Optical Warfare
DOD Mission Area: #551 - Electronic & Physical Sciences (ATD)   Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		16,214	16,808	15,818	22,802	Continuing	N/A
2222	Advanced Electro-Optical Countermeasures	6,611	6,250	6,420	8,256	Continuing	N/A
431G	Electro-Optical Warfare	9,603	10,558	9,398	14,546	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced development, risk reduction and feasibility/military worth demonstration of countermeasures against surface-to-air and air-to-air weapons, electro-optical, infrared, or laser guidance, pointing and tracking systems. anti-aircraft artillery (AAA) and radar directed surface-to-air missile (SAM) systems use some form of Shoulder fired SAMs and air launched missiles have been developed to In addition, the are moving toward on their airborne interceptors which makes it imperative that Electro-Optical/Infrared (EO/IR) countermeasures to this significant new threat be developed. Strategic, tactical, and airlift aircraft that operate over or near hostile territory may be exposed to these weapons. Currently, the only

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	16,214	17,808	20,165		Continuing	N/A

FY 1986 Difference: Reduction of $4,300 is the result of a share of undistributed reductions to support higher priority Air Force requirements.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. RELATED ACTIVITIES: The efforts in this program are closely coordinated with Program Element (PE) 63718F, Electronic Warfare Technology and other Air Force electro-optical, electronic warfare, and reconnaissance and target acquisition programs. Coordination with the Army and Navy on their advanced development work in similar areas is

accomplished through joint reviews conducted by the Joint Technical Coordinating Group and the Joint Director of Laboratory's Technical Panel on Electronic Warfare. Maximum utilization of common optical hardware and techniques is stressed; equipment developed under other programs is modified only enough to perform those functions peculiar to the countermeasure problem. New developments are undertaken only when the technology base does not exist to satisfy the specific function required. Exploratory development efforts are phased into this program from Program Element 62204F, Aerospace Avionics. Completed electro-optical efforts are transitioned into engineering development under PE 64710F, Reconnaissance Equipment; PE 64738F, Protective Systems; and PE 64739F, Tactical Protective Systems. Joint Air Force/Navy efforts include an Advanced Infrared Countermeasure System; several tail warning receiver developments; an optical countermeasures defense suppression system and aircraft Joint Air Force/Army efforts include and visual countermeasures effects and an infrared

6. (U) WORK PERFORMED BY: Testing is performed at the Air Force Armament Division, Eglin AFB, FL, and at the Naval Weapons Center, China Lake, CA. The Air Force Avionics Laboratory, Wright-Patterson AFB, OH, manages the program. The major contractors are: Scientific Applications Inc, McLean, VA, Quest Research Corporation, Washington, D.C. (431G); Honeywell Inc., Lexington, MA, (431G); Perkin-Elmer, Danbury, CT, (431G); and General Electric Corporation, Orlando, FL, (2222); there are 5 additional contractors with a total contract dollar value of $9,476 thousand.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

A. Project: 2222, Advanced Electro-Optical Countermeasures (EOCM). The primary purpose of this project is to demonstrate a system capable of locating optically or electro-optically (EO) directed surface-to-air threats; at the threat; and the threat's capability to track. In addition, an air-to-air optical countermeasures system and a coordinated EO/Radio Frequency (RF) countermeasures capability will be developed and demonstrated. Virtually all anti-aircraft guns and surface-to air missiles use some form of The United States has systems. This project is a science and technology effort to develop electro-optical countermeasure systems. User requirements are documented in Tactical Air Forces (TAF) Required Operational Capability (ROC) 20-68, 312-80, and Strategic Air Command (SAC) ROC 4-76. Additional testing of the ALQ-179 EOCM Pod was conducted and will be completed in FY 85. Design studies for CORONET PRINCE optical threat acquisition and cuing system capable of being carried on fighter aricraft were completed. Continuing improvements are underway for Advanced EOCM systems including and reliability and maintainability improvements all of which are necessary to demonstrate practical supportable systems are compatible with tactical aircraft. Studies will continue to define the effects of interacting with sensors and threat systems. For FY 1985: initiate procurement of the Coronet Prince prototype; which will design, develop, fabricate, assemble, and flight test an EOCM system capable of cueing threat location to the weapon system. Continue risk reduction development transmitters and receivers; demonstrate and flight test combined EO/RF countermeasures techniques. The Countermeasures. Against Fighters program was initiated to develop a brassboard for an air-to-air optical countermeasure

system. In FY 1986 advanced development efforts will be at the systems and component level. An operational Electro-Optical Countermeasures (EOCM) system Coronet Prince prototype will be built and flight tested. An EOCM system capable of meeting the year 2000 threat will be addressed. Technology suitable for the Integrated Electronic Warfare System (INEWS, PE 63718F) will be addressed. Advanced development of will continue, and the development of two dimensional staring array detectors for EOCM system implementation will also continue. The Countermeasures Against Fighters program will also be continued.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 431G, Electro-Optical Warfare

A. Project Description: The purpose of Project 431G is to demonstrate advanced development countermeasures against enemy air defense guidance systems which operate in the optical spectrum

Examples of such systems are IR heat seeking missiles which home in on aircraft jet engines, and television cameras, which can track airborne targets and provide guidance to enemy anti-aircraft systems. Improvements in these systems and development of new weapons using parts of the optical spectrum require continuing development to gain and maintain an advantage over the threat. The enemy air defense network is made up of electronic and electrooptical devices that locate, monitor, guide, and control the offensive and defensive elements. Denial of enemy use of these elements directly benefits the survivability of our aircrews and the number of weapons delivered to the target. In the past, enemy air defense systems operated only in the communications and radar frequencies (approximately 20 megahertz to 18 gigahertz). However,

Efforts in Project 431G include a supporting simulation and analysis effort that guides the allocation of funding through the evaluation of new concepts and techniques to prevent or delay detection of U.S. Air Force aircraft, receiver systems for aircraft to warn crew members and activate countermeasures and decoys and jammers to counter enemy air defense weapons. This project is a science and technology effort which supports Tactical Air Forces (TAF) Statements of Need (SON) 20-68, 312-7 304-80, 312-80, Strategic Air Command (SAC) Required Operational Capability (ROC) 4-76, and Military Airlift Command (MAC) SONs 7-81, 8-81, 9-81.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Work continued on the flare program. Due to this effort was continued in the lab and will not transition to PE 64739F until these technical problems are solved. The breadboard fabrication of the was completed and prepared for laboratory testing in FY 85. The micrometer ELJ was modified and tested for dispenser compatibility Work continued on the Advanced Laser Warning System program designed to technology. Work continued on the advanced to counter systems and Two special efforts were initiated

to address an effort to develop an advanced and an effort to investigate new technology. The Advanced Aerodynamic Flare program was initiated to refine and optimize the performance of an aerodynamic flare concept developed in an earlier exploratory development program. The goal is to control to defeat the flare A Dynamic Infrared Missile Evaluator upgrade was started that will incorporate IR Search and Track and jamming techniques. The Laser Ranging Countermeasures program was also started to develop and demonstrate an

(2) FY 1985 Program: Expendables development includes a that more closely matches the of current aircraft, an Jammer that combines the advantages of a flare with the capability of a and an Aerodynamic Flare that achieves similar to those of the dispensing aircraft. These efforts in expendables address the seeker threats. A Dual Mode Missile Warning system is being developed that permits of SAMs with by Another effort, the Silent Attack Warning System, addresses the to provide better protection of advanced high performance aircraft. Future warning systems are supported by a current program to develop to replace scanning infrared technology. The Laser Ranging Countermeasures program will be continued. Development of sources for use with a future will also be pursued. New starts in FY 85 include a High Performance Flare for protection of advanced aircraft (Mach 1.0 and 60,000 ft altitude) demonstration of a for combined IR and potential Radio Frequency (RF) protection, flight test of the Jammer, the Advanced Laser Warning System, and demonstration of an with minimal drag penalty. The development effort will be completed in FY 1985 with flight testing in FY 1986.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Efforts continuing through this period include analysis of countermeasure techniques effectiveness; simulations using the Dynamic Infrared Missile Evaluator facility, development of sources, Laser Ranging Countermeasures, Silent Attack Warning System, Dual Mode Warning System, High Performance Flare, Jammer flight test, and flight test. Scheduled for completion are development and testing of the Aerodynamic Flare, investigation of for warning receivers, and the direction-finding technology effort. New starts are planned for an advanced on-board jammer which uses sources in a closed loop system to counter advanced IR missiles, miniature laser warning receiver, and demonstration of a system that provides missile warning for attacks from the Based on the results of a Electronic Warfare technology study, additional efforts will be started for systems. Candidates for increased emphasis include electro-optical countermeasures for aircraft.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63745F
DOD Mission Area: #522 - Environmental and Life Sciences

Title: Chemical Warfare Defense
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		5,494	3,824	6,165	5,828	Continuing	N/A
2722	Biomedical Chemical Warfare Defense	5,494	3,824	6,165	5,828	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is designed to alleviate Air Force unique operational and medical problems associated with chemical warfare operations. It will demonstrate improved technology solutions to enhance Air Force capabilities to sustain mission essential operations and handle casualties in a chemical warfare environment. This includes development of equipment and operational procedures for crew protection, with emphasis on tactical air operations, personal decontamination, and casualty handling in the aeromedical evacuation system. This is a Science and Technology Program.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,554	3,824	4,301		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: The Air Force Chemical Warfare Defense program is formally coordinated with the other services. The Army is recognized as the Department of Defense lead agency for overall chemical warfare defense. Only efforts that have specific Air Force relevance or can be accomplished more economically using the Air Force's technical expertise will be accomplished in this program. Areas that have multiservice interests and are not unique to the Air Force are identified to the Army for inclusion in their overall chemical warfare defense research program. The program is also coordinated on an international basis through the Air Standardization Coordinating Committee. In addition, bilateral efforts have been established with the United Kingdom and Canada. Liaison is maintained with Air Force operational commands and US Army R&D commands. PE 62202F, Aerospace Biotechnology provides the exploratory development for transition to this effort.

6. (U) WORK PERFORMED BY: This program is conducted by the Aerospace Medical Division, Brooks AFB TX, with assistance of its laboratories at Brooks AFB TX and Wright-Patterson AFB OH. The major contractors are: A.D. Little, Inc., Cambridge MA; General Dynamics, Forth Worth TX; Scott Aviation-Sierra Products, Inc., Monrovia CA; Battelle Labs,

Columbus OH; TSI, St Paul, MN; Dynatech, Boston, MA; LSSI, Mountain View, CA; Burnswick Corp, Willard, OH; and Pall Corp, Glenn Cove, NY. There are six additional contractors with a total contract value of $1.5 million.

7. (U) SINGLE PROJECT LESS $10 MILLION IN FY 1986:

A. (U) Project: 2722, Biomedical Chemical Warfare Defense. Chemical Defense Biotechnology has been divided into five areas associated with Air Force unique chemical defense problems (1) detection, identification, and warning; (2) contamination control; (3) individual protective equipment; (4) collective protection; and (5) medical systems. To consolidate and validate our total chemical defense requirements a system analysis concept (master plan) for each of the above areas was established based on users' operational needs. From these studies, the Aerospace Medical Division will develop technological plans to meet these needs and direct the advanced development of: (1) air and groundcrew eye/respiratory protective equipment compatible with current aircraft design, chemically hardened aircraft environmental control systems and crew protective clothing; (2) equipment to detect and warn of the presence of toxic agents at levels which degrade performance and identify which agent is present; (3) procedures and equipment/facilities to avoid contamination by toxic agents and to decontaminate if avoidance fails; and (4) specific medical and air evacuation support procedures and equipment such as vital signs monitors, patient respiratory equipment, and medical decontamination materials and procedures.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Two master plans were completed in this program: one for individual protective equipment and one for collective protection. A technology transition plan and a long range development plan were initiated. Other accomplishments include: developed a personal contamination sensor (PECOS) for monitoring chemical agents on surfaces, agent tested the on-board-oxygen generator system; flight demonstrated the advanced chemical defense aircrew respirator (ACDAR); developed a single patient ventilator jointly funded by the Army; performed a medical shelter design effort; developed a test apparatus to quantify goodness-of-fit of chemical defense (CD) masks; improved hand and foot protection; and tested a ground and aircrew liquid cooling system. In FY 1984, the program office also continued and improved the efforts on chemical defense gear compatible combat spectacles, contact lenses, piezoelectric chemical detectors, improved sensitivity of the PECOS, and continued analysis of the four echelon medical treatment system. In addition, this program initiated development of a vital signs monitor, medical personnel ensemble, a different eyes/respiratory protection approach (In-Helmet System), improved aircrew respiratory protection (filter system), and an interim medical decontamination capability.

(2) (U) FY 1985 Program: The program will complete and transition the four echelon treatment analysis, medical personnel ensemble, interim medical decontamination, in-helmet system, advanced chemical defense aircrew respirator (ACDAR) and personal contamination sensor (PECOS). The F-16 aircrew cockpit ingress/egress and flexibility of chemically hardened environmental control system will be established with user coordination. The program will conduct Testing & Evaluation and flight demonstrate four respirator units. Three contracts (surface acoustic wave

integrated chemical detection and warning system, and filter life indicator), standardized testing, and updating system analysis (master plans) will be initiated.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Efforts continued from FY 1985 include hand and foot protection, integrated chemical detection and warning system (ICDWS) development specifications, standardized testing, filter change indicator system specification, contamination control decision aid, and cockpit filtration. New initiative will be in ensemble improvement such as technology transition in ground/air crew liquid cooling, in point detectors, such as surface acoustic wave (SAW) detectors and dosimeters, and in medical systems such as patient wound contamination monitors. advance ventilators and verification of four echelon treatment.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) In-Helmet System Transitioned	FY 85
(2) (U) Advance Chemical Defense Aircrew Filter Assembly System Transitioned	FY 85
(3) (U) Quantitative Chemical Defense Mask Fit Test Transitioned	FY 85
(4) (U) PECOS Transitioned	FY 85
(5) (U) Medical Personnel Ensemble Transitioned Delivered	FY 85
(6) (U) Vital Signs Monitor Transitioned	FY 86
(7) (U) Advanced Chemical Defense Aircrew Respirator (ACDAR) Transitioned	FY 86
(8) (U) Hand and Foot Protection Transitioned	FY 86
(9) (U) Contamination Control Decision Aid Delivered	FY 86
(10) (U) Integrated Chemical Detection and Warning System (ICDWS) Development Specifications Transitioned	FY 86
(11) (U) Cockpit Filtration Technology Delivered	FY 87

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63750F
DOD Mission Area: #551 - Electronic & Physical Sciences (ATD)

Title: Counter-Countermeasures (CCM) Advanced Development
Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		8,960	10,444	14,444	17,447	Continuing	N/A
2333	Tactical Radar Electronic Counter-Countermeasures (ECCM)	2,800	3,140	3,600	3,600	Continuing	N/A
2334	Airborne Radar Electronic Counter-Countermeasures	2,400	3,400	5,190	5,900	Continuing	N/A
2335	Communication & Navigation Electronic Counter-Countermeasures	2,410	2,504	3,058	4,300	Continuing	N/A
2347	Optical Counter-Countermeasures	1,350	1,400	2,596	3,647	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This science and technology base program element is the only Air Force advanced development program element for general counter-countermeasures (CCM) for ground based radar, tropo-scatter and extremely high frequency (EHF) communications, airborne radar and electro-optical weapons and sensors. Individual Air Force programs are responsible for developing CCM into their systems; however, this technology base program element is vitally needed to assist these programs by providing generic CCM that can be incorporated into both developmental and fielded systems. Technologies developed under this program feed directly to fielded systems and also establish a data base for future systems.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Costs
RDT&E	7,960	10,444	12,734		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program will affect strategic offense and defense and general purpose force activities, and responds to a wide range of requirements. Technical coordination will be effected with laboratories and commands of the other Services, as well as in-house Air Force technical agencies and facilities and the operational commands. Project 2334 is feeding PE 64201F, Aircraft Avionics Equipment Development, which is developing generic radar improvements for current Air Force airborne fire control systems (e.g., F-15), and includes joint developmental efforts with the Navy's Pacific Missile Test Center and the Naval Weapons Center. Project 2333 feeds technology demonstration into PE 27412F, Tactical Air Control System; PE 27417F, Airborne Warning and Control System (AWACS); and PE 63789F, Command, Control and Communications (C3) Advanced Development. Project 2335 feeds C3 efforts into the Airborne Warning and Control System. Project 2347 feeds into PE 64710F, Reconnaissance Equipment; works in conjunction with PE 63203F, Advanced Avionics for Aircraft and PE 63208F, Reconnaissance Sensor/Processing Technology; and is coordinated with related efforts at the Naval Research Laboratory and the Army's Harry Diamond Laboratory.

6. (U) WORK PERFORMED BY: The Advanced Airborne Surveillance Radar efforts have been conducted by the Boeing Corp. Seattle, WA; Westinghouse, Baltimore, MD; and Grumman Aerospace, Bethpage, NY. Decoy studies for current and follow-on tactical radars have been performed by GRC, Santa Barbara, CA and General Electric, Utica, NY. Advanced airborne radar electronic counter-countermeasures (ECCM) techniques are being pursued by Hughes Aircraft, Los Angeles, CA; Technology Service Corporation, Santa Monica, CA; Norden Systems Inc., Santa Ana, CA; Westinghouse, Baltimore, MD; and Raytheon, Bedford, MA. The low cost 20 megahertz (MHz) data link is being developed by Hughes Aircraft, Los Angeles, CA. The extremely high frequency (EHF) effort is being conducted by Litton Amecom, College Park, MD. Rome Air Development Center, Griffiss AFB, NY, has program management responsibility and project responsibility for tactical radar and communication/navigation CCM; the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH, have project responsibility for airborne radar CCM and optical CCM. Some tasks will be performed by Air Force computer simulation facilities or other agencies possessing necessary expertise or resources.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2333, Tactical Radar Electronic Counter-Countermeasures. This project develops ECCM technology applicable to search and surveillance radars such as TPS-43, APY-1/APY-2 (E-3A AWACS), and generic future radars,

Tasks include development and demonstration of: advanced radar mainbeam technology to counter noise jamming and interference; the Advanced Airborne Surveillance Radar (AASR) as an advanced ECCM follow-on to AWACS; and anti-radiation missile (ARM) alarm and decoy technologies to negate enemy destructive countermeasures. FY 1984: TPS-43 ARM alarm and decoy developments completed and transferred to full scale development. Started assembly of the Advanced Mainbeam ECCM Technology Radar (AMETR) phased array antenna. Fabricated initial AASR active conformal antenna array transmit/receive (T/R) modules and assembled subsection. Initiated AASR simulation study of radar/sensor integration. FY 1985: Complete fabrication and testing of AMETR antenna, and begin design, fabrication, and testing of subarray receiver to implement

adaptive antenna nulling technology. Manufacture additional Advanced Airborne Surveillance Radar (AASR) transmit/receive (T/R) modules. Complete design of AASR antenna subarray and initiate fabrication. FY 1986: Complete AASR tasks begun in FY 1984. Complete fabrication and begin testing of the Advanced Mainbeam Electronic Counter-Countermeasures (ECCM) Technology Radar (AMETR) subarray receivers. Complete fabrication of AASR antenna array and integrate it with 64 T/R modules. Complete sensor integration study determining optimum sensor mix for the AASR platform.

B. Project: 2334, Airborne Radar Electronic Counter-Countermeasures. This project develops ECCM technologies and concepts used to reduce susceptibility of current and future airborne weapon systems to enemy electronic countermeasures (ECM) and supports the USAF Airborne Radar ECCM Master Plan.

FY 1984: Completed data collection and analysis of F-15/F-16 potential ECM susceptibility through instrumented flight tests. Initiated twelve contracts to study and develop ECCM technologies applicable to F-15/F-16/B-1B radar systems and follow-on weapon systems such as the Advanced Tactical Fighter (ATF). Efforts include spread spectrum waveforms, simultaneous transmit and receive (STAR) concepts (Joint Air Force/Navy effort), passive situational awareness, and ECCM technologies to counter advanced enemy jamming techniques.

FY 1985: Complete FY 1984 study and development efforts. Initiate follow-on STAR development, advanced airborne radar vulnerability assessment, and terrain following (TF) radar ECCM technique study. FY 1986: Complete TF radar study. Pursue demonstration of advanced threat air-to-air ECCM techniques, radar spread spectrum waveforms, STAR concepts, and passive ECCM techniques to be applied to F-15/F-16, B-1B and other advanced airborne weapon systems. Initiate advanced radar ECCM efforts and the adaptive agile radar ECCM concept for development of an ECCM technology base for the early 1990s.

C. Project: 2335, Communication and Navigation Electronic Counter-Countermeasures. This project develops and demonstrates adaptive digital data/voice communications and navigation CCM technologies to protect tactical Command, Control and Communications (C^3) assets from enemy disruption and exploitation.

Primary emphasis is on airborne and mobile ground based tactical command and control elements and advanced weapon data link guidance. FY 1984: Initiated design and fabrication of jamming/intercept resistant extremely high frequency (EHF) communication advanced development model for air-to-air voice communications. Continued development of low cost 20 megahertz (MHz) data link to provide airborne digital jamming resistant communications network. Schedule slipped six months due to an FY 1983 funding cut. FY 1985: Complete low cost 20 MHz data link development and deliver two user terminals to Rome Air Development Center for testing. Continue EHF data/voice program. Initiate Jam Resistant Communications (JARECO) development to reduce jamming/intercept vulnerability through advanced signal processing techniques. FY 1986: Continue EHF data/voice and JARECO efforts. Initiate development of highly mobile (survivable) digital communications for the future distributed tactical air control system (QUICK COMM). System will provide jamming resistance through adaptive use of multiple

advanced Electronic Counter-Countermeasures (ECCM) technologies (multi-frequency, antenna nulling, adaptive interferrence cancellation, etc.).

D. Project: 2347, Optical Electronic Counter-Countermeasures. This project develops electro-optical (EO) CCM technologies applicable to advanced weapon/reconnaissance systems (F-15, F-16, B-1B, Advanced Tactical Fighter (ATF), etc.) to reduce vulnerability and mission degradation in a hostile EO environment

Involved is the total spectrum of EO systems, such as Forward Looking Infrared (FLIR), carbon dioxide (CO_2) laser radars, Infrared Search and Track (IRST), laser designators, etc. FY 1984: Continued development of CM hardened FLIR technologies through improvements to the optics, detector, mechanical and electrical systems. Initiated a countermeasures assessment of EO target recognizers. FY 1985: Continue development of CM hardened FLIR technologies. Initiate the second phase of the CM assessment of EO target recognizers. FY 1986: Continue CM hardened FLIR effort and pursue hardware demonstration of developed EO CCM technologies. Continue the countermeasures assessment of EO target recognizer. Initiate a vulnerability assessment of CO_2 sensors and multi-EO system concepts to establish an engineering data base of EO CM effects.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63751F Title: Training Systems Technology
DOD Mission Area: #522 - Environmental and Life Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,590	5,070	2,324	2,448	Continuing	N/A
2359	Pilot Performance Measurement System	669	40				3,902
2361	Maintenance Training Simulation	275					5,500
2362	Computer-Based Maintenance Aids for Technicians	1,185	725	424			4,934
2557	Advanced On-the-Job Training System	792	1,835	1,900	2,000	2,700	10,388
2744	Unified Data Base Application*	225	1,500				
2745	Logistics for Combat Readiness Maintenance*	444	970				
3056	Air Combat Assessment and Debriefing System				448	13,200	13,648

* Projects 2744 and 2745 are in PE 63106F in FY 1986.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a Science and Technology Program which funds research and development of new and better training systems technologies to increase proficiency and productivity of Air Force personnel and to lower training costs. The Air Force must continuously train large numbers of new and experienced personnel in a wide variety of skills to operate and maintain increasingly complex weapons and support systems. A prototype replacement for the current paper and manpower intensive on-the-job training system will be developed using state-of-the-art technology. The Advanced On-the-job Training System (AOTS) will improve on-the-job training and training management at unit, Major Command, and Air Staff levels. Continuing efforts in aircrew training and performance measurement will include development of an air combat assessment and debriefing system which will allow the recording and replay of air-to-air and air-to-ground combat training missions at the unit level without range instrumentation. Other efforts include development of portable intelligent computer-assisted instruction technology for training in remote and bare-base environments and development of an automated technical order system for maintenance technicians.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	4,478	5,070	4,881		Continuing	N/A

FY 1986 reduction reflects the transfer of projects 2744, Unified Data Base Applications, and 2745, Logistics for Combat Readiness Maintenance, to PE 63106F, Logistics Systems Technology.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Related Air Force program elements are 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; 63227F, Advanced Simulator Technology; and 63704F, Manpower and Personnel Systems Technology; 63106F, Logistics Systems Technology. Related Navy and Army Program Elements are 62757N, Human Factors and Simulation Technology; 63701N, Human Factors Engineering Development; 63720N, Education and Training; 63727N, Navy Technical Information Presentation System; 62722A, Manpower Personnel and Training; and 63743A, Education and Training. There is a Memorandum of Agreement with the Military Airlift Command (MAC) that outlines responsibilities for development of a pilot/aircrew performance measurement system.

6. (U) WORK PERFORMED BY: Major contractors are: Logicon, Incorporated, San Diego, CA (2359); University of Dayton Research Institute, Dayton, OH (2362); and Rockwell International, Los Angeles, CA (2362). There are five additional contractors ($983 thousand). The program is managed by the Air Force Human Resources Laboratory, Brooks AFB, TX. Three laboratory divisions support this program element: the Logistics and Human Factors Division (AFHRL/LR), Wright-Patterson AFB, OH; the Operations and Training Division (AFHRL/OT), Williams AFB, AZ; and the Training Systems Division (AFHRL/ID), Lowry AFB, CO.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2362, Computer-Based Maintenance Aids. This project is classified in the human factors Congressional category. A need exists to provide the maintenance technician with current technical data under hostile/peacetime conditions and reduce the cost of maintaining technical orders. To meet this need, a computerized, deployable technical information storage, retrieval and diagnostic system will be developed to enhance the technician's repair capability and improve combat readiness. This project will initially develop, demonstrate and evaluate a nonportable prototype intermediate maintenance (shop-level) computerized technical order system which will include an interactive terminal that interfaces with a computer-based technical data system. Based upon data obtained from this effort, a prototype portable computer-based maintenance aids system will be developed for the flightline technician.

The system will substantially reduce technical data search and time required by Air Force technicians to repair aircraft weapons systems. In FY 1984, baseline program specifications were developed, and the nonportable system for intermediate shop maintenance was completed. During FY 1985, the nonportable maintenance aid will be demonstrated in an intermediate maintenance shop at Offutt AFB NE, and development of a prototype portable system will begin. In FY 1986, the portable prototype will be available for final development and technology transition under Program Element 63244F, Aircraft Non-nuclear Survivability, Project 2899, Aircraft Battle Damage Repair.

B. (U) Project: 2557, Advanced On-the-Job Training System (AOTS). This project is classified in the simulation and training devices Congressional category. Approximately 70 percent of Air Force technical training is accomplished by on-the-job training (OJT). More than 70,000 people Air Force-wide are undergoing OJT at any one time; however, the system has not been significantly changed since its inception almost 40 years ago. Currently, OJT is labor intensive, limited by excessive administrative burdens, and is not responsive enough to unique job site training requirements. The Advanced On-the-job Training System will permit vastly improved definition of training and performance requirements, and training management. This will increase OJT effectiveness and training quality thereby increasing individual and unit productivity and readiness in peacetime and combat capability in wartime. In FY 1984, the AOTS site selection study was completed and a Memorandum of Agreement (MOA) was signed with the Tactical Air Command (TAC) for use of job sites at Bergstrom AFB TX, for development and test of the system. Statements of work for the site management and the development contracts were completed and manning of the operating location at Bergstrom AFB began in the 4th quarter of FY 1984. In FY 1985, development of four interrelated subsystems will be initiated. Management, evaluation, computer support, and personnel subsystems will be developed. Also, an instructional systems development team will begin development of job site training requirements in FY 1985. In FY 1986, development of all subsystems will continue with emphasis on the management and evaluation subsystems to identify training requirements necessary to achieve task proficiency, automate airmen training records, schedule resources, assess OJT quality, and make OJT cost and capacity estimates.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63752F Title: DOD Software Engineering Institute
DOD Mission Area: #551 - Electronic & Physical Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	0	5,000	11,742	14,686	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the creation and operation of the DOD Software Engineering Institute (SEI) to accelerate transition of rapidly evolving software technology into computer intensive weapon systems. The SEI will operate as a Federal Contract Research and Development Center through the provisions of a cost reimbursement contract with Carnegie Mellon University, Pittsburgh, PA. As modern weapon systems have become more dependent on computers, the problems encountered in developing and supporting reliable, cost-effective software for those weapon systems computers have grown to epidemic proportions. DOD has undertaken three complementary software initiatives to supplement and focus current service programs that are developing technology to solve these problems. The SEI will be the only program focusing on generic software technology transition common to all military services and Defense agencies.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	0	7,983	11,940		Continuing	N/A

The Congress directed a reduction in FY 1985 from the projected end strength of eighty to fifty people.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program will be closely coordinated with several existing DOD military service programs. PE 63226F, DOD Common Programming Language (Ada), developed the Ada language standard and supported the initial development of Ada Programming Support Environments. The SEI, in contrast, will integrate and establish the common generic DOD environment for the development and support of Ada applications. PE 63756A, Advanced Software Technology (STARS), will develop common software engineering tools and methods which the SEI will upgrade for production applications and integration for use by the military services and Defense agencies. PE 62746A, Tactical Automated Data Processing Technology; PE 63526N, Advanced Computer Technology; PE 63723A, Command and Control; PE 63728F, Advanced Compter Technology; and PE 64201F, Aircraft Avionics Equipment Development, are developing service-unique and application-unique software technology, while the SEI will focus on generic technology transition common to all of DOD. PE 64740F, Computer Resources Management Technology, has principally emphasized transition of JOVIAL technology in specific program applications throughout the Air Force, while the SEI will provide, in a single location, a resident body of expertise to address technology transition problems common to all of DOD, focusing on Ada, and involving greater participation of industry and academia.

6. (U) WORK PERFORMED BY: Carnegie Mellon University, Pittsburgh, PA has been selected to implement and operate the DOD Software Engineering Institute as a designated Federal Contract Research and Development Center under contract to the Air Force out of Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. Contract negotiations are in progress. Manpower control will be administered by the Department of Defense. General policy and program guidance will be provided by a Joint Advisory Committee to be established. A Department of Defense Plan for Administration of the Software Engineering Institute is being drafted with planned provisions similar to those of the Administration Plan for the Lincoln Laboratory (PE 63250F).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63752F, DOD Software Engineering Institute

A. (U) Project Description: The DOD established Software Engineering Institute (SEI) will be managed by the Air Force with participation by the other military services and Defense agencies. Need for the SEI was documented in the reports of the DOD Joint Task Force for Software Technology for Adaptable, Reliable Systems (STARS), March 1983, and of the blue-ribbon Industry/Academia SEI Study Panel administered for the Computer Systems and Software Directorate of the Office of the Deputy Under Secretary of Defense Research and Advanced Technology by the Institute of Defense Analyses (IDA), 18 November 1983. The SEI will focus on rapidly accelerating the transition of improved modern computer software technology into DOD weapon systems. Emphasis in the SEI will be placed on identification of need-driven and technology supplied opportunities, evaluation of prototype software tools and methods, integration of life-cycle automated software development and support environments, and support for use of integrated environments in the development and life-cycle support of computer-intensive weapon systems which fall within the classification of Mission Critical Computer Resources. The SEI will also provide technical advice and consultation to the military services and Defense agencies. The SEI will complement existing in-house and contracted activities of DOD laboratories and development organizations. It will provide expert assistance in the identification of technological opportunities and will upgrade the prototype software products of DOD laboratories to production quality and integrate them into a common service production and support environment for direct use in system development by the services' product offices.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable. This is an FY 1985 new start.

(2) (U) FY 1985 Program: In anticipation of an end strength of 250 people to be reached in FY 1989, personnel strength during FY 1985 will increase from zero to fifty. About half of available resources will be expended on technology transition and direct support to the military services and Defense agencies. Issues associated with proprietary software data rights and protection of classified software will be identified and preliminary approaches to their resolution will be planned. The other half of available resources will be expended on planning, administration,

clerical and unique start-up activities, including establishing interfaces between the SEI and other governmental and non-governmental organizations, recruitment of SEI personnel, establishing facilities and capital equipment, long-term program planning, and routine clerical/administrative functions.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Education and training efforts and research critical to the primary functions of technology transition and direct support, will be started. Technical consultation to the services and agencies will focus initially on the use of the DOD Common Higher Order Language (Ada) and on use of available Ada support tools and environments. A common, state-of-the-art, integrated Joint Services Software Engineering Environment (JSSEE) will be completed under the STARS program and established at the Software Engineering Institute for adaption and use by the services' and agencies' software development programs. Evaluation and benefit analyses of existing Ada development tools and limited reengineering to incorporate them into the JESSE will be performed. Resolution of issues associated with proprietary software data rights and protection of classified software will continue.

(4) (U) Program to Completion: This is a continuing program. Future activities of the Software Engineering Institute will continue to reflect strong emphasis on technology transition (60%) and direct support to the military services and Defense agencies (20%). Education and training (10%) and research activities (10%) will be instituted as needed to enhance the primary functions. Improving the state-of-the-art of software engineering environments will continue to receive emphasis, including greater responsibility for definition of software tool interface specifications, for the evaluation and validation of environments, and for the development of technology for wide-bandwidth, high data rate communication networks between DOD software technology development organizations.

C. (U) Major Milestones:

	Milestones	Dates
(1) (U)	Contract Award	November 1984
(2) (U)	Manning level of 50 people reached	September 1985
(3) (U)	Establish JSSEE at SEI	September 1986
(4) (U)	Full manning strength of 250 people reached	September 1989

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63789F Title: Command, Control & Communications Adv Development
DOD Mission Area: #551 - Electronic & Physical Sciences (ATD) Budget Activity: #2 - Advanced Technology Development

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		14,365	16,700	26,273	31,352	Continuing	N/A
2314	Tactical Air Surveillance	10,447	9,500	15,882	17,666		
2315	Automated Tactical Intel	0	1,900	3,785	5,366		
2317	Tactical Information & Distribution	2,845	2,500	2,060	2,426		
2321	Advanced Systems Concepts	285	1,675	3,261	3,527		
2478	Tactical C^3I Architecture	788	1,125	1,285	767		
3192	Tactical Optical Disk System	0	0	0	1,600		

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops and demonstrates surveillance, communications and intelligence technology to support the maintenance of air space superiority and close air support. It provides fabrication of advanced development models for testing and demonstration.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Costs
RDT&E	14,365	23,595	33,351		Continuing	N/A

Congress denied funds for Project 2315 in FY 1984. Project was restarted in FY 1985.
Congress reduced funds in FY 1985 in light of termination of the Advanced Tactical Radar (ATR) contract.
Air Force reduced funding in FY 1986 and FY 1987 in light of termination of the Advanced Tactical Radar (ATR) contract.
Project 3192, Tactical Optical Disk System, transferred from Program Element 63728. Project is a FY 1987 start.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Related Program Elements include: 62702F, Command, Control and Communications; and 63742F, Combat Identification Technology, for emergent technology. 27411F, EIFEL Improvements; 27412F, Tactical Air Control System Improvements; 27422F, Tactical Air Control System Communications; 27431F, Tactical Air Intelligence Systems; 64321F, Joint Tactical Fusion Program; 27435F, Tactical Imagery Processing, Exploitation and Dissemination; 63020F, Reconnaissance Sensor Development; 63718F, Electronic Warfare; and 63726F, Fiber Optic Development, for engineering development of demonstrated solutions to operational requirements. Projects within this program element are coordinated with Army, Navy, Marine Corps and other DOD activities.

6. (U) WORKED PERFORMED BY: The program is managed by Air Force Systems Command, Andrews AFB, MD, with project efforts being conducted by the Electronic Systems Division, Hanscom AFB, MA, and Rome Air Development Center (RADC) Griffiss AFB, NY. Current contracts are for solid-state module design architecture studies. Contractors are: General Electric, Syracuse, NY; Raytheon, Wayland, MA; Westinghouse, Baltimore, MD; Sperry, Long Island, NY; MACOM, Burlington, MA; and Syracuse Research Corporation, Syracuse, NY. MITRE Inc, Bedford, MA provides support for Project 2478.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2315, Automated Tactical Intelligence. This is the only advanced development program in the Air Force to develop and maintain the technology base required to meet tactical operational intelligence requirements of the future. It will develop and evaluate the following capabilities: (1) rapid and accurate automated processing of multisource digital imagery for use by decision makers; (2) reception, correlation, processing and display of output from those sensor systems expected to be in the Air Force inventory in the FY 1985-1990 time frame; (3) the ability of new techniques/equipment, such as Automated Decision Aids to support intelligence analysts; (4) support to the Joint Tactical Fusion Program. The program was not funded in FY 1984 as a result of Congressional language which incorrectly perceived duplication of effort with other DOD programs. The Advanced Imagery Exploitation (AIE) task establishes an RADC test-bed for multi-source digital imagery exploitation with emphasis on transitioning technology to emerging imagery system programs. The FY 1985 Advanced Sensor Exploitation (ASE) task continues development of software correlation algorithms to support Joint Tactical Fusion Program development. In FY 1985 the Tactical Air Intelligence System (TAIS) modules task will begin application of artifical intelligence technology to improve situation assessment capabilities of the tactical operations/intelligence analyst. Additional hardware/software will be added to the imagery exploitation test-bed in FY 1986. Technology for advanced target location using a digital point position data base and an advanced parallel processor architecture for target detection will be developed in ASE. Modification to laboratory correlation hardware will be implemented and tested for transition to the All Source Analysis System (ASAS)/Enemy Situation Correlation Element (ENSCE) baseline system under the ASE task. Work will begin in FY 1986 on developing a targeting aid for the tactical operations/intelligence analyst under the TAIS modules task.

B. (U) Project: 2317, Tactical Information Processing and Distribution. This project develops and demonstrates complete full-time connectivity among a multitude of different computers and terminals using Flexible Intraconnect Local Area Networks (FILANs). This project also develops and demonstrates various interfaces with standard tactical/strategic military and commercial equipments/circuits. Fabrication and laboratory tests were completed for FILAN core capability. FILAN installation at the North American Aerospace Defense (NORAD) offsite test facility (OSTF) was completed and initial demonstrations were performed in FY 1984. In FY 1985 the range of FILANs will be extended to 10 kilometers and development will incorporate fiber optics into FILANs. Development of multi-network interoperability techniques using standard protocols will begin. Development will also begin on integrated radar communication technology to support an Advanced Tactical Surveillance System being developed under Project 2314. FILAN capabilities will be expanded to include a demonstration within a Tactical Air Control Center (TACC) which will use required higher level protocols in FY 1986. Development will continue on communications capability integrated with future tactical radar systems (Integrated Radar Communications). Development will begin on survivable wide-area networks for organic tactical air control systems (Quick-Communication Radio).

C. (U) Project: 2321, Advanced System Concepts. This project will improve decision making procedures through the use of computer based decision aids and decision making tools (Artifical Intelligence (AI) techniques) to support Command and Control (C^2) operations in high stress and time critical environments. The efforts within this project will be developed and realistically demonstrated using the new Rome Air Development Center's (RADC) Battle Management Laboratory. The design and specification for the Tactical Expert Mission Planner (TEMPLAR) effort were completed and actual implementation of AI techniques for preparing an Air Tasking Order (ATO) began in FY 1984. TEMPLAR implementation phase will continue in FY 1985. Additional development of TEMPLAR will use a form of rapid prototyping which will implement changes quickly and allow system evolution and testing to progress rapidly. The first use of the RADC Battle Management Laboratory will be the development and demonstration of the Ground Attack Control Center (GACC) capability which will be carried out in this project beginning in FY 1985. The GACC testbed demonstration will support a GACC Initial Operational Capability (IOC) of 1989. TEMPLAR development will continue in FY 1986 and will expand capabilities to support Senior Battle Staff and Control and Reporting Center (CRC) decision makers. This development work will begin expansion into a family of decision aids to support other tactical planning and C^2 functions. GACC development continues with initial demonstrations in late FY 1986.

D. (U) Project: 2478, Tactical C^3I Architecture. Project 2478 develops Tactical Forces Command, Control, Communications and Intelligence (C^3I) mission area studies in conjunction with Air Force Theater Tactical Commands and in cooperation with the Tactical Air Forces Interoperability Group (TAFIG). This project involves the development of road maps, task sequences, schedules, and cost estimates for the orderly and evolutionary improvement of the Tactical Air Control System (TACS). Study for United States Air Forces Europe (USAFE) C^2 alternatives for fighter operations in the Central Region was completed in FY 1984. FY 1985 efforts will include a 10 month architecture study aimed at C^3 in the post 1990 timeframe as well as a study of USAFE C2 alternatives in the Southern Region. FY 1986 efforts will piggyback on an existing study for development of Pacific Air Forces (PACAF) architectures. Also in FY 1986, work will begin on establishing an overall master future architecture for Tactical C^3 systems which will continuously be updated as new C^3 systems enter development.

E. (U) Project: 3192, Tactical Optical Disk System. The Tactical Optical Disk System (TODS) project will design, deliver and test an integrated suite of digitial optical disk systems that have been ruggedized and made transportable. TODS equipment will include a 10-disk automated recorder/player, a single disk recorder/player, and a desk top/rack mounted play only unit. These digital optical disks will provide the capability to improve data storage and retrieval capability, storage density and data capture rates by 2-3 orders of magnitude over present magnetic tapes. The TODS capability is required to deal with the real time and near-real time multi-sensor inputs to intelligence exploitation systems such as the TR-1 Ground Station and Strategic Air Command (SAC) Deployable C^2 Center.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2314, Tactical Air Surveillance

A. (U) Project Description: This is an advanced technology program focused toward an Advanced Tactical Surveil-

lance System (ATSS). The goal of the ATSS is to provide continuous and reliable air surveillance, and current depiction of the friendly and hostile airspace situation. It includes (1) detection of air activity (position, altitude, heading, identity and flight size); (2) continuous tracking of all detected objects; (3) air activity information exchange between all users (internetting); (4) identification and classification of targets (cooperative and non-cooperative and (5) sensor track correlation. This project evaluates advanced technology such as solid-state Transmit/Receive (T/R) modules, conceptual designs, and systems engineering, and demonstrates equipment and/or procedures that address stated users' requirements for an Advanced Tactical Surveillance System.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The Advanced Tactical Radar (ATR) contractor announced an unacceptable cost growth in the ATR advanced development model contract. After evaluation of alternative proposals by Electronic Systems Division (ESD), a recommendation was made to terminate the ATR contract and restructure Project 2314 based on lessons learned to address the high-cost/high-risk technologies required to develop a next-generation tactical surveillance radar. The Surveillance Internetting Identification (SI/ID) task demonstrated single site netting of an Advanced Tracking System (ATS) for the AN/TPS-43E radars. Development efforts continued for the critical solid-state T/R modules.

(2) (U) FY 1985 Program: Seven in-house or competitive efforts will be initiated for the restructure of the ATR program addressing high-cost/high-risk technology areas. Major development of critical T/R module technology will begin. SI/ID efforts will provide a demonstration of dual-site netting of AN/TPS-43E radars and will initiate the netting concept with an E-3A aircraft. The SI/ID task will initiate design of a passive surveillance system for the ATSS.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 program involves continuation of seven high technology areas intitiated in 1985. The seven technology areas are (1) detailed radar system tradeoff studies, (2) development and test of solid-state T/R modules and demonstration of solid-state active phased array radar, (3) development of a technology base to reduce costs and increase efficiency of phase shifters for phased array radars, (4) reassessment of antenna sidelobe performance requirements via simulation/field tests, (5) demonstration of automatic, adaptive radar control in noise/clutter/Electronic Counter Measures environment (ECM), (6) reassessment of tracking computation requirements, and (7) development and test of a highly stable brassboard transmitter with variable duty cycle.

C. (U) Major Milestones:

Milestones*	Dates
(1) (U) Surveillance Network Dual-Site Test	July 1985
(2) (U) Type A Specification for ATSR	September 1988

*Change in milestones from FY 1985 Descriptive Summary due to restructuring of project following the termination of the Advanced Tactical Radar (ATR) contract.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63311F
DOD Mission Area: #111 - Land-Based Strike

Title: Advanced Strategic Missile Systems (ASMS)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		74,250	98,000	173,934	215,580	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Air Force program develops, applies, and proves ballistic missile technology by conducting advanced development for operational intercontinental ballistic missile (ICBM) system applications. Early development work is pursued to gain confidence in engineering feasibility of new technologies and concepts to insure their readiness for full scale development and to provide timely solutions for identified ICBM force deficiencies, mission changes, and evolving threats. ASMS also conducts tri-Service intercontinental range flight testing of exploratory reentry vehicles and penetration aid systems.

Soviet throwweight advantages, their capability to field advanced anti-ballistic missile defenses [ ] their continuing program to upgrade Soviet offensive effectiveness (e.g., increased missile accuracy), their increased pace in projecting force, all point to a need for the United States to be prepared to upgrade the missile force with offsetting advanced weapons.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	74,250	108,304	179,971		Continuing	N/A

(U) The $10.304 million FY 1985 reduction is due to an $8.304 million reduction by the FY 1985 Department of Defense Appropriation Act and a $2 million Air Force reprogramming action. The FY 1986 funding reflects a $6.037 million transfer into FY 1987 that resulted from schedule adjustments to compensate for delayed FY 1984 and 1985 program starts.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program includes reentry systems development previously pursued in the Advanced Ballistic Reentry Systems (ABRES) program (PE 63311F) and the Advanced Intercontinental Ballistic Missile Technology program (PE 63305F). The program is coordinated with the Army's Systems Technology Program and Ballistic Missile Defense Advanced Technology Center; the Navy's Strategic Systems Program Office; the Defense Advanced Research Projects Agency; the Defense Nuclear Agency; the Department of Energy, Military Applications; Government laboratories and testing facilities; and other agencies associated with ballistic missiles, reentry technology, and assessment of basing modes for high survivability and endurance. Efforts are coordinated with the Minuteman program (PE 11213F) and the ICBM Modernization

(Peacekeeper, Small ICBM) program (PE 64312F) for development of advanced reentry vehicles, penetration aids systems, advanced missile guidance, evaluation of defended basing and demonstration launches. Tri-Service and intra-Air Force coordination is achieved through annual program review and working level exchanges. Effective coordination and avoidance of duplication with the ICBM (intercontinental ballistic missile) Modernization and Minuteman programs is achieved through joint management and collocated program offices within the Ballistic Missile Office.

6. (U) WORK PERFORMED BY: The responsible Air Force agency is the Ballistic Missile Office, Norton Air Force Base, CA. Major contractors include: McDonnell Douglas Astronautics, Huntington Beach, CA (maneuvering reentry vehicle technology, defense suppression vehicle); TRACOR Aerospace, Austin, TX (penetration aids, deployment system); AVCO Corporation, Wilmington, MA (advanced nosetip testing, defense suppression vehicle, penetration aids, launch hardware); Charles Stark Draper Laboratory, Cambridge, MA (advanced guidance technology); TRW Incorporated, Redondo Beach, CA (system engineering/technical assistance, flight test targeting). The ASMS program currently maintains contracts with 63 contractors (39 of which support the small business innovation research program) and makes extensive use of Government laboratories. Total definitized value of current contracts is $225.7 million, with some periods of performance extending through calendar year 1988.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63311F, Advanced Strategic Missile Systems

A. (U) Project Description: This program is a continuing activity that conducts advanced development of key ballistic missile, reentry, and basing systems/subsystems to correct deficiencies and maintain effectiveness of our ICBM force. This development process accomplishes system definition and requirements analyses, preprototype fabrication, and both ground and flight testing, all properly paced to achieve baselined milestones identified and coordinated by the using command (Strategic Air Command) and the implementing command (Air Force Systems Command). The current and FY 1986 programs directly address four of the Strategic Air Command's Statements of Operational Need.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: The countermeasure components [ ] of the Peacekeeper and Minuteman III penetration system were successfully flight tested. Active and passive decoys were fabricated for FY 1985 flight testing on Minuteman I boosters. The penetration aids deployment system (PADS) design and testing continued in preparation for total penetration system flight testing. Concept definition contracts were awarded for candidate defense suppression vehicles that use maneuver capability and radar homing to locate, fly to, and disable defensive radars to allow reentry vehicle penetration. Concept definition was initiated to investigate advanced guidance concepts applicable to maneuvering reentry vehicles (MaRVs). Ground testing for nonnuclear impacting munitions was completed. A contract was awarded to conduct the Severe Environment Nosetip Test (SENT) program that will flight test advanced nosetip concepts in severe reentry environments (high temperature/pressure, dust, rain, ice). Offense/defense analyses

with the Army continued to support realism of potential Army approaches to ballistic missile defense (BMD) and assess Air Force intercontinental ballistic missile (ICBM) penetration capability and tactics against Soviet BMD systems. ASMS provided flight test support for the Army's Homing Overlay Experiment (two flights), the Navy's shape-stable nosetip flight test, and the ASMS penetration aids advanced countermeasures flight tests (six flights).

(2) (U) FY 1985 Program: The Peacekeeper and Minuteman III penetration system decoy candidates (active and passive) will complete a series of three flight tests which also includes a plasma effects decoy to measure signal attenuation through reentry plasma. The penetration aids deployment system (PADS) will be fabricated and functionally tested in preparation for flight testing on Peacekeeper in FY 1986 and 87. Prototype system design for a defense suppression vehicle will be continued in conjunction with subsystem ground testing. Maneuvering reentry vehicle (MaRV) system definition will be initiated for an accurate defense evading MaRV. The MaRV advanced guidance concept definition will culminate in selection of two concepts to proceed into design definition and aircraft captive carry flight testing. Fabrication of advanced nosetips will be initiated to support FY 1987-89 Severe Environment Nosetip Test (SENT) flight tests. Initial mobile target attack studies will evaluate potential upgrades and new systems that will provide ICBM assets the capability to attack relocatable targets. Minuteman I flight test support will be provided for three ASMS penetration aid flights.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 funds will continue advanced development of penetration aids for Peacekeeper and Minuteman III as a countermeasure to Moscow defense upgrades in progress and as a hedge against deployment of defenses beyond Moscow. The PADS will be flown with both decoys and advanced chaff on Peacekeeper flight tests in FY 1986 and 87. These ICBM flight tests will provide data needed for operational design and reentry signature evaluation. Fabrication and ground testing of advanced nosetip candidates (passive, transpiration cooled, gas jet cooled) will continue to support FY 1987-89 SENT flight testing. These flights will test the nosetip performances in stringent reentry environments (bad weather, nuclear effects, depressed trajectory) to increase reentry vehicle survival and accuracy. Joint studies will be continued with the ballistic missile defense community to understand and evaluate offense and defense relationships (i.e., "red-blue" studies).

Funds will also be spent to continue the preprototype system design for a defense suppression vehicle. Experimental testing (ground tests, sounding rocket tests) will be conducted to validate design concepts and support selection of one design. The accurate evader MaRV system definition will evaluate physical, performance, and trajectory (defense interceptor evasion and accuracy) requirements and capabilities. Aircraft captive carry flight tests of MaRV advanced guidance subsystem components and sensors will assess performance characteristics. A system requirements study will be initiated for a penetration aids system for the MaRV. An aggressive concept definition will be conducted on ballistic and maneuvering reentry vehicle penetration concepts to defeat [ ] BMD systems. Concept definition will begin for an ICBM mobile (relocatable) target kill capability. Costs for ASMS advanced development tasks were estimated as of November 1984, based on negotiated contractor prices and Government experience on similar advanced development programs. Ongoing ASMS program costs are category III, Budgetary, and planned efforts are category IV, Planning.

(4) Program to Completion: The remaining flight test of the integrated penetration aid system will be conducted on a Peacekeeper missile in FY 1987 in preparation for transitioning into full scale development. Follow-on

Program Element: #63311F | Title: Advanced Strategic Missile Systems (ASMS)
DOD Mission Area: #111 - Land-Based Strike | Budget Activity: #3 - Strategic Programs

Minuteman I flight tests will be conducted in the outyears for upgrades to the Peacekeeper and Minuteman III penetration system options (e.g., advanced decoys, defense suppression, maneuvering vehicles), to meet the evolving Soviet defensive threat. A defense suppression vehicle design will be preprototyped and flight tested by FY 1991. Candidate advanced guidance concepts will complete aircraft captive carry flight testing with one concept selected and integrated into a preprototype evader maneuvering reentry vehicle (MaRV) for flight testing in the early 1990's. Mobile target attack concepts will be narrowed and enter technology validation in FY 1987, ground testing in FY 1988-89, and flight testing in the early 1990's. Advanced development of other missile subsystems (e.g., arming and fuzing, advanced guidance, ground systems), tailored weapons for and counters to directed energy weapon ballistic missile defense systems will be initiated in FY 1987 and 88. This is a continuing program.

C. (U) Major Milestones: Not applicable since decisions have not been made to pursue engineering development, production, or deployment of these systems. Advanced development milestones are described above.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63364F
DOD Mission Area: #113 - Airborne Strike

Title: Short Range Attack Missile II (SRAM II)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING) : ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	24,000	78,958	200,108	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Strategic Air Command requires an improved Short Range Attack Missile (SRAM) to enable the B-1B and Advanced Technology Bomber (ATB) to successfully attack heavily defended targets and suppress improving enemy defenses. SRAM II, formerly called Advanced Air-to-Surface Missile or AASM, will provide the penetrating bomber a supersonic, air-to-ground nuclear missile that will significantly compound enemy defense requirements, prevent optimization of defenses against subsonic low altitude targets and enhance bomber operational flexibility. The required performance improvements are attainable in a minimum-risk development program using existing technology. It is not the intent of this program to stress technology to its limits, but rather to build a state-of-the-art SRAM II using available technology.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	0	54,418	127,994		Continuing	N/A

Congress approved reprogramming of $6.5 million in FY 1984 RDT&E funds for the purpose of initiating the AASM system definition studies. As part of the Congressionally directed reduction of the FY 1985 defense budget, the FY 1985 RDT&E request for AASM was reduced by $26.0 million. Of the revised request of $28.4 million, $25.0 million was approved by Congress.* This reduction resulted in a major restructuring of the program that is reflected in changes to the funding profile and program milestones. Full scale development has been delayed to early FY 1986 and initial operational capability has been postponed to second quarter FY 1992.

*Further reduction by $1.0 million is the result of USAF reprogramming action.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Procurement appropriation TBD.

5. (U) RELATED ACTIVITIES: Integration of SRAM II into the B-1B (PE 64226F) and ATB avionics systems, B-1B multi-purpose launcher and Common Strategic Rotary Launcher (PE 64234F) is planned.

6. (U) WORK PERFORMED BY: Boeing Aerospace Company - Seattle, WA; Martin Marietta, Orlando Aerospace - Orlando, FL; and McDonnell Douglas Astronautics - St Louis, MO; will be awarding parallel development contracts for system definition studies and component risk reduction demonstrations. The SRAM II program will be directed by Air Force System Command's Aeronautical Systems Division, Strategic System Program Office, at Wright-Patterson AFB, OH.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63364F SHORT RANGE ATTACK MISSILE II

A. Project Description: Although the Air Force is satisfied with the overall qualities of SRAM, there are four major concerns with the weapon system that need to be addressed. First, the remaining SRAM inventory is steadily declining

The third concern is that missile performance improvements are required to challenge and defeat improving enemy defenses and fourth, the SRAM warhead lacks modern electrical and explosive safety features. The significant costs of modifying the SRAM warhead and missile (which do not address the inventory problem) can be avoided with the timely development of SRAM II. SRAM II is the most cost effective solution to these concerns -- a timely, minimum-risk development of a state-of-the-art SRAM. The operational concept is based upon more than a decade of experience with SRAM and the acquisition strategy exploits available technology to reduce technical risk and shorten the acquisition cycle.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Activities were restricted to internal program planning. Late approval of the reprogramming request prevented initiation of contract activities in FY 1984.

(2) (U) FY 1985 Program: SRAM II was a major system new start in FY 1985. Three parallel development contracts have been awarded for a ten-month pre-FSD (full scale development) phase. Pre-FSD activities include system definition studies, evaluation of performance requirements, preliminary design, development of program plans and selected component risk reduction demonstration. Our program strategy is based on over 12 years of operational experience with SRAM and, therefore, a discrete demonstration/validation phase is not planned. We will be requesting Secretary of Defense approval for an accelerated development. Approximately $1.0 million of the reprogrammed FY 1984 funds will be used to study Strategic Relocatable Target (SRT) architecture. The SRT effort will continue using a small portion of the FY 1985 funding. In addition to our pre-FSD activities, which will result in a comprehensive system specification prior to FSD, carrier aircraft avionics and launcher integration studies will define interface requirements for the B-1B, ATB and their respective launchers.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Significant performance improvements are achievable by exploiting available technology. The maturity of these technologies permits initiation of Full Scale Development (FSD) in second quarter FY 1986. Competition is a key element of the acquisition strategy which allows the total acquisition cycle to be shortened and controls program costs. Preliminary plans for the FY 1986 FSD activity include two competing contractors through Preliminary Design Review (PDR). Prime contractors will design missile hardware, develop necessary software through PDR and define support equipment and interface requirements. B-1B and Advanced Technology Bomber (ATB) integration activities will include development of interfaces, definition of carrier avionics requirements, and preliminary design and preparation for modifications. Launcher activities will include interface definition, preliminary design and preparation for PDR. Program includes wind tunnel testing, Survivability/Vulnerability studies, communications, system engineering and Reliability and Maintainability analyses. Cost data is based on preliminary estimates (Cost Category IV, Planning).

(4) (U) Program to Completion: This is a continuing program. Continuation of the parallel development contracts through Critical Design Review (CDR) is planned. Following CDR, a single prime contractor will be selected to complete missile development, begin flight tests on the B-1B and prepare for production. Competition will be continued beyond CDR at the component/subsystem level. Pilot production of the development missiles is being considered as a way to ease the transition into missile production. The long lead for that production phase is expected to begin in FY 1988. The integration schedule for ATB cannot be addressed in this document -- Special Access Required.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Defense Resources Board approved new start		July 1983
(2)	(U)	SRAM II study contract award	*(May 1984)	February 1985
(3)	(U)	Full Scale Development	*(June 1985)	May 1986
(4)	(U)	First flight		January 1989
(5)	(U)	Initial operational capability		Second Quarter 1992

* Dates presented in Fiscal Year 1985 Descriptive Summary.

(U) EXPLANATION OF MILESTONE CHANGES

(2) (U) Late approval of FY 1984 reprogramming request delayed contract awards.
(4) (U) Program was restructured as a result of reduced FY 1985 funding request, FSD was delayed accordingly.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63716F
DOD Mission Area: #122 - Strategic Air Defense

Title: Atmospheric Surveillance Technology (AST)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	N/A	4,908	4,978	26,726	Continuing	N/A
2955	Architecture Development	N/A	608	678	2,300	Continuing	N/A
2956	Technology Development and Demonstration	N/A	4,300	4,300	24,426	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Atmospheric Surveillance Technology is an advanced development program to conduct studies and develop an architecture for a future air defense system. This system will require survivable surveillance sensors which have improved capabilities against low observable air-breathing threats. The air defense system must also remain effective through all phases of nuclear conflict. This program evaluates existing technology, fabricates experimental hardware, and conducts feasibility demonstrations for application to a survivable air surveillance and defense system.

These radar systems will provide cost effective warning of an

Further capability is needed to satisfy additional air

defense objectives

This

program provides the only link between exploratory development projects (6.2 programs) and a future strategic defense engineering development program that will ultimately lead to a survivable air defense system for deployment in the late 1990s. A new capability will be integrated with and complement our ongoing atmospheric tactical warning programs to provide full deterrence against air-breathing attack upon North America.

PE #: 63716F

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	N/A	4,908	6,887		Continuing	N/A

FY 1986 request adjusted to reflect requirement for transitioning technology from the laboratory to this advanced development project.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: This technology development and demonstration program will transition the technology developed in current exploratory development programs to full scale development efforts for systems with flexible and survivable bomber and cruise missile surveillance capabilities. This program will be conducted in coordination with PE 63424F, Missile Surveillance Technology.

6. (U) WORK PERFORMED BY: This work will be managed by Air Force Systems Command; Electronic Systems Division, Hanscom AFB, MA; and Rome Air Development Center (RADC), Griffiss AFB, NY. Since this effort was an FY 1985 new start, contractors have not been selected at this time.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2955, Architecture Development. The purpose of this project is to develop a system architecture for a survivable air surveillance and defense system. The architecture development will consider pre-, trans-, and post-attack operational requirements and will evaluate the use of ground, air and space-based elements. For the pre attack phase of conflict, architecture development will concentrate on proliferated surveillance/warning against airbreathing penetrators. In the trans-attack phase, the concentration will be on survivable surveillance capabilities to support battle management and handoff to any engagement element. For post-attack, reconstitution capability will be a prime consideration. The architecture development project will consider integration with existing and developmental atmospheric warning and Command, Control, Communications and Intelligence (C^3I) networks. Cost and capabilities analyses will be accomplished under this project to identify systems meeting survivable air defense requirements for the least cost. This project will be accomplished in parallel and will be continuously interfacing with the Technology Development and Demonstration project. The project will be initiated in FY 1985. Development of a data base of observables (i.e. what phenomenologies could be exploited to observe the target) associated with the

threat during all phases of attack penetration will be started. Studies of multispectral surveillance candidates and architectural approaches which exploit the observables to provide pre-attack surveillance augmentation of existing systems, trans-attack battle management and resource allocation, and post-attack reconstitution will also begin. The FY 1986 RDT&E funds will be used to complete the observables data base work begun in FY 1985. Studies of multispectral candidates will continue with some candidates being selected for further development under Project 2956 of this PE. Development of plans and schedules for testing the advanced and engineering development models (developed by Project 2956) will be initiated. These test plans will assure that the developing and operating commands have sufficient data so that decisions may be made whether to enter a sensor technology item into a Full Scale Development Program should such a program be established. The selection of candidates for development and testing will continue until an architecture is developed that satisfies all surveillance requirements of an advanced air defense system. The architecture effort will be performed in close association with PE 63424F, to assure the best mix of ground, air, and spaceborne systems is acheived. This is a continuing program.

B. Project: 2956, Technology Development and Demonstration. This project will evaluate available technology and develop promising ground and airbased surveillance sensor candidates to the point where experiments against single and multiple targets can be performed. The impact of advanced technology air-breathing threats will be assessed to assure surveillance effectiveness over the entire range of threat vehicles. Utility appraisal will include the pre-, trans-, and post-attack phases of conflict. Technologies which will begin development in FY 1985 include

will continue throughout FY 1986. Data will be obtained on track processing response time and performance limits for low and slow types of targets.

This work will be a key feature if proliferation of low acquisition and operations and maintainence cost sensors is to be a viable answer to the survivability issue. Plans beyond FY 1986 will depend upon progress made in FY 1985 and 1986 on technologies under this program and in laboratory efforts. If progress continues as expected, the following will occur.

This demonstration system will be used to test the sensor under a variety of conditions.

may be developed for further testing before a basing mode is selected.

Hybrid systems (transmitter and receiver on different platforms) will be developed and tested. Ground based, airborne, and space based platforms will be examined for use in hybrid systems.

The data fusion process, multispectral data analysis, and battle management problems will be addressed and solutions demonstrated. System specifications for sensor and data processing system put into engineering development will be the product of this effort. This is a continuing effort.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63735F
DOD Mission Area: #331 - Strategic Command and Control

Title: WWMCCS Architecture
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		10,912	10,968	8,036	4,859	Continuing	N/A
2188	Air Force Worldwide Military Command and Control System, Systems Engineering Planning and Support	10,912	10,968	8,036	4,859	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force Worldwide Military Command and Control System (WWMCCS) Architecture program is our mechanism for ensuring that more than eighty strategic command, control, and communications (C^3) programs fit together as a cohesive whole. Several of these are mentioned in paragraph 5, below. These efforts amount to an overall system engineering and planning activity in support of user needs: for identifying interoperability and intersystem engineering deficiencies, for proposing solutions to problems related to current Air Force strategic C^3 systems, and for planning and development actions for programs directed by the Deputy Secretary of Defense.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	14,412	10,968	10,458		Continuing	N/A

FY 1984: Funding reduced to support higher priority requirements.
FY 1986: Funding reduced to support higher priority requirements.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Specific program elements that relate to PE 63735F are: PE 12431F, Defense Support Program (DSP), which provides the Mobile Ground Terminals with which Jam Resistant Secure Communications (JRSC) equipment will interface; PE 33605F, Satellite Communications Terminals, which provides site preparation, interconnect operations and maintenance, and manpower for JRSC terminals at Air Force sites; PE 41840F, Military Airlift Command (MAC) Command & Control (C^2) System, which funds for research and development of enhanced C^2 capabilities for MAC, beginning in FY 1984; PE 33126F, Defense Communications System (DCS) Long Haul Communications, which provides the

procurement funds for the Secure Conferencing Project (SCP). All of the above tasks require systems engineering and interface definition for implementation at Air Force installations.

6. (U) WORK PERFORMED BY: Funds for the Jam Resistant Secure Communications (JRSC) program are provided to the Navy as the Lead Military Department. The Air Force Worldwide Military Command and Control System (AFWWMCCS) Program Office, Electronic Systems Division, Hanscom Air Force Base, MA, conducts 70 percent of the remaining work in-house with MITRE Corp., Bedford, MA technical support. A number of small contracts for systems engineering and planning support have been used for the balance of the work. Contracts have been let with the following companies: Analytic System Engineering Corp., Burlington, MA; Information Systems and Networks, Washington, DC; and Aerodyne Research Inc., Billerica, MA.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2188, Air Force Worldwide Military Command and Control System (WWMCCS), Systems Engineering Planning and Support

A. (U) Project Description: This project addresses two functions: intersystem engineering (Air Force generated requirements) and WWMCCS Selected Architecture implementation (requirements directed by the Office of the Secretary of Defense). First, this program provides for systems engineering and other technical analyses to adequately integrate and standardize systems of communications, command, and control centers and sensors for the Air Force strategic forces. The second effort of this program concerns the improvements recommended in the WWMCCS Architecture directed by the Deputy Secretary of Defense in 1976. These are JRSC, SCP, and the Joint Crisis Management Capability (JCMC).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Analytical and planning efforts continued in support of JRSC. A Request for Proposal to industry to develop the JRSC Network Controller was written. The Network Controller will enable command centers to receive and acknowledge sensor data without saturating the satellite communications medium during stressed conditions. Air Force requirements baseline for the WWMCCS Information System were developed and cost estimates prepared for site preparation/integration. The utility of a mobile Readiness Command (REDCOM) Command Center was examined in the context of REDCOM's post-attack role and its overall Command, Control, and Communications (C^3) capabilities/requirements. The program office began to analyze the C^3 interfaces to higher authority for various postulated basing modes of the small Intercontinental Ballistic Missile. A coordinated Interface Requirements Document (IRD) for the Strategic Air Command's Headquarters Emergency Relocation Team was completed and a final IRD for RAPIER begun. Analysis of the long-range evolution of Tactical Warning/Attack Assessment (TW/AA) was performed with the focus on survivability.

(2) (U) FY 1985 Program: Analysis and planning efforts on behalf of SCP will end in FY 1985 as the program achieves an early operational capability in the Pacific. We will award a contract for development of the Jam Resistant

Secure Communications (JRSC) Network Controller and achieve an initial operational capability. The Joint Crisis Management Capability (JCMC) hatch-cover mounted antenna will be developed. Further definition of the Strategic Air Command, Readiness Command, and the North American Aerospace Defense Command architectures for survivable and enduring command, control and communications (C^3) for strategic, conventional and air defense forces will be produced. Follow-on work will be accomplished to develop a small Intercontinental Ballistic Missile (ICBM) C^3 architecture.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Development of C^3 concepts for the small ICBM will continue, with studies planned for mobile launch control center concept tradeoffs and requirements for Worldwide Military Command and Control System communication gateways. Connectivity requirements for the Atmospheric Surveillance and Warning Mission Area will be analyzed, with particular emphasis on cruise missile detection and reporting.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) JRSC Initial Operational Capability for Tactical Warning/Attack Assessment (TW/AA)	2Q FY 1985
(2) (U) JRSC Fixed Commanders'/Executing Commanders' (FC/EC) Interim Network	1Q FY 1986
(3) (U) Secure Conferencing Project (SCP) Early Operational Capability, Pacific	4Q FY 1985
(4) (U) SCP Early Operational Capability, Europe	FY 1986
(5) (U) JRSC Final Operational Capability for TW/AA	FY 1988
(6) (U) JRSC FC/EC Final Connectivity	FY 1989
(7) (U) SCP Final Operational Capability	FY 1989

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64226F
DOD Mission Area: #113 - Airborne Strike

Title: B-1B
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		737,200	465,000	367,438	136,323	30,319	3,179,642
2731	B-1B	737,200	465,000	367,438	136,323	30,319	3,179,642

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The B-1B is a strategic long range multirole weapon system which is able to perform the missions of conventional bomber, cruise missile launch platform, and nuclear weapons delivery system in both the tactical and strategic roles. Production of the B-1B addresses the national requirements to increase our targeting flexibility, to redress the relative decline of our strategic capabilities, and to revitalize our strategic deterrent forces. The B-1B program will significantly enhance the manned bomber portion of the strategic TRIAD while preserving the vitally needed flexibility for worldwide nonnuclear force projection in response to unforeseen contingencies. The program was mandated by Congress under Public Law 96-342 and fulfills Strategic Air Command Required Operational Capability 3-66 (Revised), New Strategic Manned Bomber, dated 22 November 1978, and the Long Range Combat Aircraft Mission Element Need Statement, dated 8 June 1981.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	737,200	508,277	375,234		170,381	3,234,454
Aircraft Procurement	6,124,500	7,712,300	5,586,100		0	25,068,400

(U) During Congressional enactment of the FY 1985 budget, the RDT&E request was reduced by $43.277 million without rationale. $50 million in the FY 1983 and $58 million in the FY 1984 procurement appropriations were labelled "contract savings" and identified as a possible source of Peacekeeper financing. $32 million in the FY 1985 procurement request were not appropriated because the purchase of common strategic rotary launcher (CSRL) conversion kits was considered premature. $50 million in the initial spares funding were also denied. The FY 1986 Procurement request increased by $38 million due to revised inflation indices. The FY 1986 RDT&E request decreased by $7 million due to revised inflation indices.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	6,124,500	7,630,700	5,624,000	0	0	25,024,700*
Quantities	10	34	48	0	0	100
Military Construction**:						
Funds	5,900	95,740	210,984	24,416	9,376	346,416

*This total reflects $108.3 million in FY 83 and FY 84 Procurement that was identified as a potential source of Peacekeeper funding.

**Military Construction funds are not part of the B-1B acquisition baseline.

5. (U) RELATED ACTIVITIES: The aircrew training devices and military construction for the B-1B are funded outside the B-1B baseline. These devices will be developed under Program Element 64227F, Flight Simulator Development. The program will be managed by the Simulator Program Office at Wright-Patterson AFB, OH. The Air Force anticipates the upper limit for five B-1B weapon system trainers, one mission trainer, six cockpit procedural trainers, and support equipment will be $300 million (FY 1981$).

6. (U) WORK PERFORMED BY: The B-1B program is in its Full Scale Development/Production phase. It is managed by the B-1B System Program Office, Aeronautical Systems Division, Wright-Patterson AFB, OH. The B-1B System Program Office has overall integration responsibility for the development of the B-1B bomber.

(U) Rockwell International, North American Aircraft Operations, Los Angeles, CA, is the B-1B airframe manufacturer. Rockwell is responsible for achieving aircraft design integrity. Boeing Military Airplane Company, Seattle, WA, is the Avionics Subsystem Interface contractor responsible for integrating the B-1B avionics, and providing avionics equipment not furnished by the government. AIL Division, Eaton Corporation, Deer Park, NY, develops and builds the B-1B defensive avionics system. General Electric Company, Aircraft Engine Group, Cincinnati, OH, is responsible for the design and development of the B-1B propulsion system.

(U) Several government agencies provide specialized assistance. For example: the facilities at Holloman AFB, NM, are used to measure radar cross-section characteristics; the wind tunnels at the Arnold Engineering Development Center, TN are used for comparative analyses; and the Air Force Materials Laboratory and Air Force Avionics Laboratory at Wright-Patterson AFB, OH are used in the development effort.

(U) The majority of the flight test will be done at the Air Force Flight Test Center, Edwards AFB, CA, but several other Department of Defense test ranges will also be used: White Sands Missile Range, NM; Eglin AFB, FL; Point Mugu Naval Air Station, CA; Utah Test and Training Range, UT; China Lake Naval Weapons Center, CA; Nellis Range Complex, NV; and others.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2731, B-1B

A. (U) Project Description: The B-1B, a new long range combat aircraft, embodies current advances in aeronautical and countermeasures technologies required to enhance aircraft survivability in projected high threat environments. Recent events confirm an ever increasing need for a long range, large payload, flexible weapon system capable of worldwide rapid power projection.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: FY 1984 efforts emphasized full scale development and production activities. Major activities included: completion of Design Development Structural tests; completion of wind tunnel testing; continuation of offensive and defensive avionics installation, integration, and qualification; completion of weapons delivery system ground qualification testing; and continuation of Integrated Logistics Support activity. The flight test of B-1A number 2 continued with the addition of propulsion, weapons carriage, and weapons separation work before its loss on 29 August 1984. Engineering, fabrication, and avionics modifications were conducted on B-1A number 4. The initial flight test of B-1A number 4 occurred on 30 July 1984. Major flight test objectives include evaluation of production offensive and defensive avionics groups, and aircraft/systems development.

(2) (U) FY 1985 Program: B-1B system development will continue throughout FY 1985 with increasing emphasis on flight test activities. Significant events during this period include the initiation of flight testing on B-1B number 1 in October 1984 and nuclear certification testing. Defensive avionics system capabilities will undergo planned upgrades, including incremental software updates. B-1A number 4 will continue the evaluation of the offensive and defensive systems. This prototype will also undergo initial adverse weather testing and heavyweight buildup evaluations. B-1B number 1 will complete its checkout and begin to validate/verify previously acquired flutter, airloads, stability and control, vibration/acoustics, weapons launch, and performance data. Propulsion inlet, ground handling, nuclear safety, and avionics systems evaluations will be conducted. Integrated Logistics Support activities will be continued.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: B-1B system development will continue throughout FY 1986. This is the critical year for integrated systems-level flight testing, during which full weapons system capability will be demonstrated. Initial cruise missile and common strategic rotary launcher (CSRL) testing

will take place on B-1B number 9, which will begin flight testing in August 1986 with production avionics and Block 3 software. The buildup test activities will lead to air launched cruise missile (ALCM) live launches in FY 1987.

(U) B-1A number 4 will continue evaluation of the offensive and defensive avionics systems groups, heavyweight buildup evaluations, and adverse weather testing through June 1986. Installation of the Tail Warning Function will complete the defensive avionics suite. Defensive system testing will feature dense threat environment evaluations. Offensive system efforts include demonstration of terrain following capability. B-1B number 1 will complete flight testing to include airloads, vibration/acoustics, performance, weapons separations (including live short range attack missile launches), ground handling and avionics systems evaluations. B-1B number 1 testing will continue through June 1986. Additionally, B-1B number 10 will undergo climatic testing at Eglin AFB, FL in the summer of 1986. Integrated Logistics Support activities will continue.

(U) The development cost estimate was recertified to the Congress by the Secretary of Defense in January 1984. In a comprehensive cost analysis (Category I), heavy emphasis was placed on the monthly Cost Performance Reports (CPRs) submitted by the four associate contractors. As a further check on the progress of the B-1B development, the CPR data were compared to similar data on other major aircraft acquisition programs when they were at the same stage of development.

(4) (U) Program to Completion: ALCM and common strategic rotary launcher (CSRL) integration efforts on B-1B number 9 will include flutter, vibration/acoustics, performance, and separation testing. Full heavyweight capability will also be demonstrated and ALCM live launches will be conducted. Testing on B-1B number 9 is planned through September 1987. Additional effort in FY 1988 is required to complete nuclear certification tasks leading to an ALCM weapons capability date for the B-1B of March 1988. The B-1B cruise missile test program has not yet been restructured to accomodate the loss of B-1A number 2. Full operational capability will be achieved in June 1988, when the 100th aircraft is delivered to the Strategic Air Command.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Defense Systems Acquisition Review Council (DSARC) I	July 1967
(2)	(U)	DSARC II	June 1970
(3)	(U)	DSARC III	December 1976
(4)	(U)	B-1A Production Cancellation	June 1977
(5)	(U)	President Reagan's Strategic Modernization Program	October 1981
(6)	(U)	Full Scale Development Contract Award (Rockwell)	January 1982
(7)	(U)	Full Scale Development Contract Award (General Electric)	February 1982
(8)	(U)	Engineering Review	April 1982

Program Element: #64226F | Title: B-1B
DOD Mission Area: #113 - Airborne Strike | Budget Activity: #3 - Strategic Programs

(9) (U)	Full Scale Development Contract Award (AIL and Boeing)		June 1982
	Milestones		**Dates**
(10) (U)	Configuration Review		January 1983
(11) (U)	B-1A number 2 Flight Test Start		March 1983
(12) (U)	B-1A number 4 Flight Test Start		July 1984
(13) (U)	B-1A number 2 Flight Test Terminated	*(November 1984)	August 1984
(14) (U)	B-1B number 1 Flight Test Start	*(January 1985)	October 1984
(15) (U)	B-1A number 4 Flight Test Complete		June 1986
(16) (U)	B-1B number 1 Flight Test Complete		June 1986
(17) (U)	B-1B number 9 Flight Test for Cruise Missile Carriage Start		August 1986
(18) (U)	Initial Operational Capability (15 aircraft)		September 1986
(19) (U)	B-1B number 9 Flight Test for Cruise Missile Carriage Complete		September 1987
(20) (U)	Full Operational Capability (100 aircraft)		June 1988

*Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(13) (U) Loss of B-1A number 2 on 29 August 1984. Milestones associated with cruise missile testing on B-1A number 2 have been deleted.

(14) (U) B-1B number 1 flight testing started ahead of schedule on 18 October 1984.

Budget Activity: 3, Strategic Programs
Program Element: 64226F, B-1B

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Defense Systems Acquisition Review Council process was completed for the B-1A in December 1976. President Carter cancelled the production and deployment of the B-1A in June 1977.

(U) In July 1980 the United States Congress directed the Department of Defense to vigorously pursue the full scale engineering development of a multirole bomber with an initial operational capability no later than 1987. As a result of that direction, a Joint Air Force/Office of the Secretary of Defense (OSD) Bomber Alternatives Study team evaluated advanced technology aircraft, the B-1 bomber aircraft and derivatives of the B-1 aircraft, and FB-111B/C aircraft.

(U) The General Electric Company was awarded an Initial Full Scale Development (IFSD) contract for a Long Range Combat Aircraft engine in February 1981. The engine was common to the aircraft being evaluated by the Joint Air Force/OSD Bomber Alternatives Study team. On 2 October 1981 President Reagan announced his decision to build 100 B-1Bs. Rockwell International Corporation, Boeing Military Airplane Company, and AIL Division of the Eaton Corporation were awarded their IFSD contracts in October 1981. Subsequent Full Scale Development (FSD) contracts were awarded to Rockwell in January 1982 and to General Electric in February 1982. Boeing and AIL received their FSD contracts in June 1982.

(U) The B-1B program is managed by the B-1B System Program Office. This program is a continuation of the original B-1A effort. Approximately 90 percent of the B-1A airframe testing was accomplished during the original 6 years of flight test. The B-1B offensive and defensive avionics suites will require additional flight test. Examples of this testing include: examination of the coverage of the AN/ALQ-161A defensive suite, offensive avionics system integration, and an evaluation of the terrain following/forward looking radar and the inertial navigation system.

(U) The B-1B baseline test and evaluation program contains 57 months of combined Development Test and Evaluation/Initial Operational Test and Evaluation flight test leading to an initial operational capability in September 1986.

(U) B-1A number 2, a fully instrumented prototype, was used for stability and control, vibration/acoustics, dynamic response, propulsion, flutter, and weapon carriage and separation tests. This aircraft began its portion of the B-1 flight test on 23 March 1983. On 29 August 1984 it crashed during a test flight. Four flights were left in its test program. All unaccomplished tests will be incorporated into B-1B number 1's test flight program.

Budget Activity: 3, Strategic Programs
Program Element: 64226F, B-1B

(U) B-1A number 4, which was deployed to the Farnborough Air Show in September 1982, is now the primary test vehicle for B-1B defensive and offensive avionics systems. It began its portion of the B-1B flight test program on 30 July 1984 and will complete its testing in June 1986. This aircraft will be used for heavyweight buildup, offensive and defensive integration, and terrain following evaluation.

(U) The first B-1B will be used to verify previous flutter, stability and control, performance, and weapons separation testing. Currently it is planned to be the primary test vehicle from October 1984 through June 1986.

(U) B-1B number 9 will be the first cruise missile capable B-1B. It will be used to evaluate cruise missile carriage, integration, separation, and launch from August 1986 through September 1987.

(U) The majority of the flight tests will be done at the Air Force Flight Test Center, Edwards Air Force Base, California, but several other Department of Defense test ranges will also be used: White Sands Missile Range, New Mexico; Eglin Air Force Base, Florida; Point Mugu Naval Air Station, California; Utah Test and Training Range, Utah; China Lake Naval Test Center, California; Nellis Range Complex, Nevada; and others.

(U) The Reliability and Maintainability effort will be directed towards use of a stringent Parts Control Program, Reliability Development/Growth Testing, Burn-In Under Environmental Stress of all production lots, and Reliability Qualification/Production Reliability Tests for selected reliability of safety critical equipment.

(U) A Program Management Plan Executive Summary for the B-1B program has been submitted to the Deputy Secretary of Defense. The Strategic Air Command System Operational Concept was published in October 1982. A Decision Coordinating Paper, Integrated Program Summary, and Test and Evaluation Master Plan (TEMP) with associated schedules, milestones, cost estimates, and thresholds were submitted to the Office of the Secretary of Defense (OSD) in November 1983. A revised TEMP was submitted to OSD in June 1984 and was provisionally approved.

2. (U) Operational Test and Evaluation (OT&E): The Air Force Operational Test and Evaluation Center (AFOTEC) will assess the operational effectiveness and suitability of the B-1B. Operational issues and OT&E test objectives have been identified by AFOTEC with the assistance of the Strategic Air Command, for the total OT&E program consisting of combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) and Follow-on Test and Evaluation (FOT&E). Those OT&E objectives not sufficiently addressed during the combined DT&E/IOT&E will be addressed during FOT&E.

(U) The Operational Test and Evaluation (OT&E) will use all applicable B-1A test data to evaluate the B-1B. Operational suitability testing will begin during the combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) and will extend into Follow-on Test and Evaluation (FOT&E) since some support equipment will not be delivered until late in the combined DT&E/IOT&E test program.

Budget Activity: 3, Strategic Programs
Program Element: 64226F, B-1B

(U) The areas of special interest in B-1B OT&E testing will be survivability, navigation reliability and accuracy, low level penetration capability, weapons delivery, sortie generation capability, mission reliability, and diagnostic capability.

(U) Many of the data from the B-1A DT&E/IOT&E flight test are directly transferrable to the B-1B and will not have to be reevaluated. However, some deficiencies identified in the B-1A DT&E/IOT&E have been corrected in the B-1B and will be reexamined: horizontal stabilizer hinge moment, engine nozzle design, pitch trim rate, flap/slat system, engine start system, flight control nonlinear gearing, overwing fairings, inertial navigation system, weapon bay door acoustics and vibration, central integrated test system, and fuel leaks.

(U) The Program Management Directive and the Test and Evaluation Master Plan specify the OT&E responsibilities of Air Force Operational Test and Evaluation Center (AFOTEC), Strategic Air Command, Air Force Logistics Command, Air Force Systems Command, and Air Training Command.

(U) Operational Test and Evaluation Reports Published:

(1) (U) HQ AFTEC, B-1 IOT&E Final Report, March 1977 (Secret).

(2) (U) HQ AFTEC, Manned Bomber Penetration Evaluation Final Report, 30 June 1981 (Secret).

3. (U) Systems Characteristics: The B-1B contract specifications have been negotiated. The following required system parameters will be demonstrated during the 57 month combined DT&E/IOT&E flight test. This list represents the requirements imposed upon the B-1B at initial operational capability after the aircraft have been flown for approximately 2,500 flying hours.

Characteristic	Goals	Thresholds	Estimate
(U) Technical:			
(U) Weight empty (pounds)	186,000		184,350
(U) Operational:			
(U) Takeoff distance (feet) (Sea level, standard day, 20 degree wing sweep)			
440,000 pound aircraft			
470,000 pound aircraft			

Budget Activity: 3, Strategic Programs
Program Element: 64226F, B-1B

Characteristic	Goals	Thresholds	Estimate
(U) Sustained speed (Mach number)			
Best cruise at altitude			
Penetration			
(Intermediate power, sea level, standard day)			
(U) Range (Nautical miles [nm])			
Penetration mission 1/			
(U) Payload (Number of weapons)			
(U) AGM-69A (Int)	24	24	24
(U) AGM-86B (Int/ext) 2/	8/14	8/14	8/14
(U) MK-82(AIR)/MK-36DST(AIR) (Int)	84	84	84
(U) B61/B83 (Int)	24	24	24
(U) Readiness/Supportability			
(U) Technical:			
(U) Built-in Test False Alarm Rate	2%	5%	
(U) Central Integrated Test System Fault Detection Rate	0.95	0.90	

1/

2/ (U) Air Launched Cruise Missile carriage will comply with appropriate Strategic Arms Limitation/Reductions agreements.

Budget Activity: 3, Strategic Programs
Program Element: 64226F, B-1B

Characteristic	Goals	Thresholds	Estimate
(U) Operational:			
Availability (B-1B System)			
(U) Maintainability (Maintenance Manhours/Flight Hour) (B-1B System)	64	80	
(U) Meantime Between Unscheduled Maintenance Actions (B-1B System)	0.28	0.22	
(U) Weapon System Reliability 1/ (B-1B System)	0.83	0.78	

1/ (U) The term Weapon System Reliability was Mission Completion Success Probability. It is a measure of system reliability as it affects the mission, but excludes factors such as probability of kill, circular error probable, and other measures of capability.

Budget Activity: 3, Strategic Programs
Program Element: 64226F, B-1B

4. (U) Current Test and Evaluation (T&E): The Operational Test and Evaluation (OT&E) of the B-1B is in the planning phase. Active testing began on B-1A number 4, the primary avionics testbed in July 1984. The Development Test and Evaluation (DT&E) accomplished thus far has provided limited data applicable to OT&E suitability objectives. Aerial refueling has generated compatibility data suitable for OT&E effectiveness objectives. Each DT&E flight has been carefully screened for applicable OT&E data when appropriate to eliminate repeating test conditions at a later date.

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
F101-GE-102 product verification (U)	September 1983	September 1983	Engineering changes phased into production
Development Test and Evaluation (DT&E) flights (U)	CY 1983	CY 1983	45 Flights Flown in Support of DT&E Objectives
Block 0 and 1 offensive software (U)	February-October 1984		Proceeding on schedule
B-1A number 4 defensive modifications hardware delivered (U)	February-June 1984	June 1984	Complete
B-1A number 4 first flight (U)	July 1984	30 July 1984	Offensive and defensive avionics platform
B-1B number 1 first flight (U)	October 1984	18 October 1984	Rollout accomplished 4 September 1984

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Combined DT&E/Initial Operational Test and Evaluation flights (U)	October 1984-June 1986	Flutter Envelope expansion Performance and stability control Weapons Carriage

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64234F
DOD Mission Area: #113 - Airborne Strike

Title: Common Strategic Rotary Launcher (CSRL)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		62,850*	69,304*	72,629	24,497	0	314,525

* In FY 1985 and prior, CSRL was funded in PE 63258F, Common Strategic Rotary Launcher. See paragraph 5.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Common Strategic Rotary Launcher (CSRL) is a multipurpose munitions launcher for the B-52H, B-1B and the Advanced Technology Bomber (ATB). The primary purpose of CSRL is to allow the B-52H and B-1B to carry internal cruise missiles. It will also carry current and future nuclear gravity weapons and Short Range Attack Missiles (SRAM and SRAM II, formerly Advanced Air-to-Surface Missile). The CSRL will carry homogeneous loads of these weapons on the B-52H and B-1B. CSRL is designed to carry a combination of these weapons on the same launcher load for advanced bomber applications. CSRL will carry future conventional standoff munitions. The CSRL improves readiness because it increases munition delivery flexibility, reduces logistics support structure and provides growth potential for future munitions. The CSRL has also been proven to be the least cost alternative that satisfies the user's requirements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	63,215	77,304	68,711		Continuing	N/A
Aircraft Procurement*	12,000	89,500	158,900		447,400	707,800

* Contained in PE 11113F, B-52 Squadrons

A. (U) RDT&E Differences:

(1) (U) FY 1985: Congressional reduction.

(2) (U) FY 1986: Increase is due to additional flight test requirements. Flight test of CSRL will now include testing of new B-52 operational software (Offensive Avionics System Block II). This software includes an internal cruise missile capability plus other optimizations and enhancements to improve the operation of the existing software and its capabilities.

B. (U) Procurement Differences:

(1) (U) FY 1985: Congressional denial of request during enactment process.

(2) (U) FY 1986: Reduction reflects production start-up in FY 1986 rather than FY 1985.

(3) (U) Total Estimated Cost: Higher figure reflects one year program stretch-out as a result of FY 1985 action.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
Funds*	12,000	0	80,000	188,700	436,200	716,900
Quantities	0	0	5	23	68	96

* Funds contained in PE 11113F, B-52 Squadrons.

5. (U) RELATED ACTIVITIES: CSRL (PE 63258F, Common Strategic Rotary Launcher) has transitioned from Advanced Development (PE 63258F) to Engineering Development. Beginning in FY 1986, Research, Development, Test and Evaluation (RDT&E) will be accomplished under PE 64234F Common Strategic Rotary Launcher. The Air Launched Cruise Missile (ALCM) program, PE 11122F, provides certain items of support equipment for the Common Strategic Rotary Launcher. ALCM funds procure launcher test package sets for the Electronic System Test Set and launcher loader adapter hardware for the munition lift trailer.

6. (U) WORK PERFORMED BY: The Boeing Military Airplane Company (BMAC) was awarded a contract in June 1983 for launcher full scale development. The development program was awarded to BMAC subsequent to a competitive development effort. Boeing and Rockwell, El Segundo, California will each be responsible for integrating the launcher into the B-52H and the B-1B. The prime contractor is the Boeing Military Airplane Company, Wichita, Kansas. The Aeronautical System Division of Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, is developing the launcher for the Air Force.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64234F, Common Strategic Rotary Launcher:

A. (U) Project Description: This program develops a multipurpose rotary launcher providing an interface common to the B-52H, B-1B and Advanced Technology Bomber (ATB) as well as a wide variety of munitions. CSRL is the only launcher effort that will provide an internal cruise missile carriage capability for the B-52H and B-1B. The launcher is common, to the maximum extent practicable, with all three bombers. The CSRL program element funds development of the launcher and integration into the B-52H. The B-1B and the ATB each fund their own launcher integration programs.

(U) A cruise missile roadmap study determined that a highly common multipurpose launcher design could be adopted for use on all three bombers. Along with the reduction of launcher designs, support equipment was also consolidated so that the Air Force would realize maximum commonality and life cycle cost benefits.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Full scale development proceeded on schedule. The Critical Design Review was completed in March. The first developmental CSRL was fabricated and delivered to the contractor's facility for laboratory testing. All launcher components (avionics, wiring, suspension mechanisms, etc.) entered qualification testing. Engineering designs of the launcher and the interface with the B-52H were finalized. Design is complete and the system is ready for ground testing.

(2) (U) FY 1985 Program: The first B-52H aircraft modified for cruise missile carriage will be delivered to the contractor's facility for mating with the preproduction CSRL. Aircraft modification for CSRL will begin in January and will be completed in May. Ground testing of the CSRL-modified B-52 and the launcher will then begin. Functional check flights are planned in July and August before the mated system is delivered to Edwards AFB CA for flight testing. Cruise missile captive carriage flights begin in September. Four more developmental launchers will be fabricated.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full scale development of the modified aircraft and the launcher reaches peak activity as the designs are flight tested. The flight test program includes approximately 25-30 flights with the following events planned: Engineering functional flights - 2; Air Launched Cruise Missile (ALCM) captive carries - 4; ALCM jettisons - 2; ALCM live launch - 3; gravity weapon jettisons - 8; gravity weapon releases - 10; and Short Range Attack Missile (SRAM) captive carry - 2. These flights verify the design of both the launcher and the hardware modification to the B-52H. Additionally, these flights use new B-52 software which will

also be validated in conjunction with the above weapon activities. Flight testing of the new software was added to the CSRL program rather than incurring the cost of an additional test program. As such, the CSRL flight test program will nuclear certify both the hardware and the software necessary for internal cruise missile carriage. A detailed parametric estimate was used to develop the request. It reflects actual cost of developmental hardware for the system, arrayed by functional and work breakdown structure (WBS) breakouts. The estimate was revised in September 1984.

(4) (U) Program to Completion: FY 1987 is the last year of incremental funding on the CSRL contract. The request corrects B-52 hardware and software deficiencies identified during flight testing. Funds development of the CSRL modification to the B-52 Weapon System Trainer. Provides contractor support for B-1B/CSRL flight test and nuclear certification efforts.

C. (U) Major Milestones:

Milestones		Dates
(1) Initial Full Scale Development Contracts		September 1982
(2) USDR&E Decision to Commit B-1B to CSRL		May 1983
(3) Source Selection		June 1983
(4) Preliminary Design Review (PDR)		September 1983
(5) Critical Design Review (CDR)		March 1984
(6) Start B-52H ICSRL Flight Test		September 1985
(7) Complete B-52H/CSRL Flight Test		January 1986
(8) B-52H Initial Operational Capability (IOC)	(December 1988)*	FY 1990

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) Explanation of Milestone Changes:

(8) B-52H IOC slipped due to denial of FY 1985 procurement request.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64312F Title: Intercontinental Ballistic Missile (ICBM) Modernization
DOD Mission Area: #111 - Land-Based Strike Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT*	2,429,888	2,340,786	1,580,824	1,603,370	TBD	TBD

* Includes resources in the following categories:

Peacekeeper	1,962,588	1,699,686	784,124	360,600	61,400	6,780,998

Because the following two initiatives are still being defined, "FY 1987 Estimate", "Additional to Completion" and "Total Estimated Cost" columns are yet to be determined.

Small ICBM in Hard Mobile Basing	328,342	461,500	624,500	TBD	TBD	TBD
ICBM Follow-on Basing Technologies						
Hard Silo	119,458	170,000	152,200	TBD	TBD	TBD
Deep Basing	19,500	9,600	20,000	TBD	TBD	TBD

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The military need for ICBM modernization stems from the requirement to respond to the pace and scope of Soviet ICBM development which is causing an imbalance between the U.S. and Soviet strategic capability. This modernization program is built on the recognition that all ICBM tasks cannot be served by a single basing mode. The near-term response--deploying Peacekeeper in existing silos in 1986--will reduce the Soviet advantage in ICBM capability and help deter a broad spectrum of potential threats including massive conventional or limited nuclear attacks on the U.S. or our allies. For the long-term, ICBM compatibility with pending U.S.-Soviet arms control agreements and the need for flexibility in responding to possible Soviet actions are very important. To address these requirements, the long-term response includes deploying a small single-warhead ICBM in one or several basing modes, with emphasis on mobility. Further responses continue the ICBM follow-on basing technologies of silo hardening and deep underground basing. The mission is to support the U.S. strategic deterrent policy while responding to changes in the projected Soviet target base.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	2,452,237	2,440,786	1,496,030		TBD	TBD
Missile Procurement	2,157,400	3,171,900	2,832,900		6,222,400	14,384,600

(U) RDT&E: Decrease in FY 1984 is due to Congressionally-directed Small Business Innovative Research Program. Decrease in FY 1985 is due to elimination of Maneuvering Reentry Vehicles and reduced efforts in deep basing. Increase in FY 1986 is in the Small ICBM area to expand pre-Full-Scale Development contractor competition in propulsion and guidance systems.

(U) Missile Procurement: FY 1984 Peacekeeper funding and quantity were reduced by Congressional action. FY 1985 funding and quantity were also reduced to $2,500 million and 21 missiles, with $1,500 million of that total "fenced" pending submittal of Presidential report in March 1985 and further Congressional action. When approved, $1,500 million is available for missile and basing procurement from prior year unobligated funds of various service procurement accounts. Procurement funding totalling $1,000 million is immediately available for associated basing of 21 FY 1984 missiles, advanced procurement items and maintenance of Peacekeeper program contractor base.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Program Element 11215F (Peacekeeper Squadrons)						
Aircraft Procurement (Mod Kits):						
Funds	-	6,700	32,305	32,256	26,656	97,917
Quantities		1	7	8	6	22
Missile Procurement:						
Funds	2,153,500	2,500,000*	3,180,300	2,798,300	3,955,600	14,587,700
Quantities	21	21	48	48	85	223

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Military Construction:						
Funds	31,200	95,700	55,800	58,828	20,300	278,528

* Includes $1,500 million (for 21 missiles) pending Congressional release in March 1985.

The following is provided by direction of Senate Armed Services Committee. Of the 48 missiles requested for FY 1986, 36 are for deployment, 11 are for operational test and evaluation and 1 is for the aging and surveillance program.

5. (U) RELATED ACTIVITIES: This program is directly related to the results of efforts in the programs for Peacekeeper Squadrons (PE 11215F) and Advanced Strategic Missile Systems (PE 63311F). This program and the related programs are all managed within the Ballistic Missile Office, and thus close coordination is assured. PE 11215F contains the funding for both Peacekeeper military construction and missile procurement.

6. (U) WORK PERFORMED BY: The program is managed by the Ballistic Missile Office, Norton Air Force Base, CA. Testing facilities at Arnold Engineering Development Center, Tullahoma, TN, are used for motor testing. The top five ICBM Modernization Program contractors are Martin Marietta Aerospace, Denver, Colorado (Assembly, Test and Systems Support); Rockwell International Autonetics Division, Anaheim, California (Guidance and Control); Rockwell International Rocketdyne Division, Canoga Park, California (Stage IV Development); Thiokol Corporation, Brigham City, Utah (Stage I Development); and Northrop Corporation Electronics Division, Hawthorne, California (Inertial Measurement Unit). In addition, there are 14 other major development contractors. The total dollar value of the additional contracts is $3,923 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64312F, ICBM Modernization

A. (U) Program Description: In October 1981, the President initiated the U.S. strategic modernization program to counter growing Soviet threats to U.S. strategic systems. Congress subsequently directed further study of survivable ICBM basing candidates in the FY 1983 Continuing Resolution. In response, the President formed the Commission on Strategic Forces (Scowcroft Commission) to review strategic force modernization with special focus on ICBM systems. In April 1983, the Commission submitted its recommendations, which were endorsed by the President and later approved by the Congress. These called for deployment of the Peacekeeper missile in existing silos; development of a small single-warhead ICBM compatible with a hardened mobile basing

mode; and development of hardened silo and deep basing technologies. The following identifies the progress in these three categories of the ICBM Modernization Program. Peacekeeper. The Peacekeeper missile system entered full-scale development in September 1979. The major areas of effort are development of missile and basing subsystems, system integration and extensive system/subsystem testing to support the production design. The missile subsystems will include an advanced guidance set derived from the Advanced Inertial Reference Sphere (AIRS) prototype. The three booster stages will contain an advanced solid propellant, lightweight motor cases and advanced nozzles which will produce about twice the propulsion efficiency of current ICBM systems. The Peacekeeper Post-Boost Vehicle, although significantly larger than that of Minuteman, will use a similar, well-proven configuration. The Peacekeeper reentry vehicle (RV) will be the Mark-21. Basing development includes modification of the existing Minuteman silo design and launch control system and development of ground support and transportation/handling equipment. Related military construction efforts include modification/construction of test facilities at Vandenberg AFB, California (PE 64312F) to support missile flight testing; construction/modification of facilities at F.E. Warren AFB, Wyoming, (PE 11215F) for deployment and operation of the system; modification of 100 existing silos in the 319th and 400th Strategic Missile Squadrons; and modification/construction of facilities at Hill AFB, Utah, to enable logistic support of the system. Small ICBM and Hard Mobile Basing. A major recommendation of the President's Commission on Strategic Forces was for the Air Force to develop and deploy a small single-warhead ICBM. The underlying logic for this recommendation was that a small ICBM could provide long-term survivability and, with a single RV, would present a relatively low-value target compared to a large Multiple Independently-targetable RV missile. Properly based, a small survivable ICBM would be stabilizing and would enhance the arms control process. The President and the Congress concurred in this recommendation, and the Office of the Secretary of Defense (OSD) has directed the Air Force to vigorously pursue the development for the small mobile ICBM. The Air Force responded to the small ICBM decision by establishing the Deputy for Small ICBM at the Ballistic Missile Office (BMO), which is responsible for the development and acquisition of the small ICBM and basing technology. The Air Force also convened the Small Missile Independent Advisory Group, under the direction of retired General Bernard A. Schriever, to recommend an acquisition strategy and management approach for the small ICBM program. The Air Force is implementing these recommendations and is currently in the concept definition program phase assessing alternative technologies. The small hard mobile ICBM "baseline" system will build on Peacekeeper technology and incorporates a modified version of the Peacekeeper AIRS self-contained guidance subsystem and the Mark-21 RV. Parallel guidance and control development efforts are also underway. This single-warhead missile will weigh no more than 30,000 lb, have a range of approximately 6,000 nautical miles, begin full-scale development by late FY 1986 or early 1987, and will have a 1992 Initial Operational Capability. The missile will be cold launched, consist of a three-stage solid propellant booster subsystem and be augmented with a liquid post-boost deployment system. The leading contender basing mode is a hard mobile launcher on existing government reservations. ICBM Follow-On Basing Technologies. Another key recommendation of the Scowcroft Commission was to conduct a program on the hardening of structures. The development of hardening technology applicable both to the Peacekeeper missile system and small single-warhead ICBM could provide greater diversification and survivability for U.S. ICBM forces. In addition, it was determined that deep basing technology holds promise for enhancing the survivability of the U.S. ICBM force. As a result, efforts related to deep basing technology development are included in the follow-on technology category. The deep

basing concept consists of missile launch nodes and support centers interconnected by a network of tunnels and located at a sufficient depth below ground surface to ensure survivability while providing extended post-attack retaliatory capability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Peacekeeper. There were four successful flight tests in 1984. This completed the initial phase of six flight tests and demonstrated the missile's outstanding accuracy and functional performance. The data from the flight tests will be used in the assessment of technical risk areas, subsystem performance and accuracy error contributors. The first 11 production contracts were awarded for the missile (most with warranties). The basing support equipment development continued from the preliminary design review to the critical design review phase. Development and construction of RDT&E facilities at Vandenberg AFB continued. The FY 1984 Military Construction Program (MCP) included four projects at Hill AFB, UT; one project at Lowry AFB, CO; one project at Offutt AFB, NE; three projects at Vandenberg AFB, CA; and four projects at F.E. Warren AFB, WY. In the FY 1984 program, design was approximately 99% complete and construction was 34% complete. Small ICBM and Hard Mobile Basing. In FY 1984, point of departure design concepts were established for both the Small ICBM and Hard Mobile Basing. Subscale tests for survivability to nuclear blast effects were conducted for various Hard Mobile Launcher contractor vehicle designs. Missile prime item development specifications for the missile competition were established. Phase I of the weapon system definition (Missile Assembly and Test Support) competition was extended to March 1985, but with an anticipated down-select to one contractor at that time. The four Hard Mobile Launcher (HML) contractors began the task of integrating all operational concepts with vehicle performance capabilities. ICBM Follow-on Basing Technologies. An aggressive Components and Materials Test Program has demonstrated that hardness levels of 50 times those of current U.S. silos are achievable. Validation of these superhard silo designs has begun with two successful tests. Tests were conducted on 1/2 size egress seals, hard mounted foam for shock isolation, and superhard antenna penetrations. Tests were also started to characterize concrete material properties and evaluate seal pressurization capabilities. Validation of superhard silo designs has begun with two successful silo tests. A deep basing critical requirements study was completed. The study defined a six year pre-Full-Scale Development (FSD) risk reduction program to further develop key technology areas.

(2) (U) FY 1985 Program: Peacekeeper. The RDT&E flight test program will enter the second phase with four additional flight tests. Flight data will continue to be used to assess missile system performance. During FY 1985 the first flight from an actual launch facility will occur at Vandenberg AFB. The test data from the flights will be used to evaluate Mark-21 reentry vehicle performance, the silo launch environment and the silo and transportation and handling vehicle designs. During FY 1985, the last of the Critical Design Reviews will be completed for the basing support equipment. The technical publications will begin to be validated, then verified. The FY 1985 Military Construction Program includes three projects at Hill AFB, one project at Vandenberg AFB and 28 projects at F.E. Warren AFB. Design is 78% complete and construction has not yet started. Small ICBM and Hard Mobile Basing. A down-selection to one contractor in the missile assembly and test contractor competition is planned for March 1985. A down-select to two contractors in Hard Mobile

Basing Support (including launcher vehicle design) occurred in January 1985. One-sixth scale hardness testing in blast tubes of competing contractor designs occurred prior to the January down-select. Further simulation testing will also occur at one-sixth scale later in FY 1985. The Defense Nuclear Agency will define nuclear environments and support the development of simulation facilities for these tests. Additional competitions will select contractors for propulsion stages 1, 2, and 3; launch control and communication systems and ordnance. A comprehensive test program will continue to validate design approaches and assess technology risks. An advanced ordnance concept will be tested. Laboratory tests will be conducted on guidance system components, security components for access delay/denial and advanced communication concepts. Shock tube and above ground high explosive tests will evaluate hardness of scaled hard mobile launcher (HML) designs. Mobility tests will be conducted on two designs. The point of departure operations concept will be adjusted to include the best aspects of the efforts of the HML contractors. ICBM Follow-on Basing Technologies. The Components and Materials Test Program will continue with emphasis on structural features such as personal access systems. The first large size superhard silo blast test will be conducted on a 150" inside diameter (ID) tube silo (alongside a 50" ID silo for scaling comparison). A test of the egress system through simulated debris will validate egress concepts. Mechanical tests on advanced egress systems will demonstrate the feasibility of these concepts for use in advanced silo design. The major effort in deep basing will be to conduct pre-Full-Scale Development (FSD) technology studies in the area of power and heat sinks, life support, egress and excavation technology, and computer aided design technology.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Peacekeeper. The final weapons system testing will be completed (ground tests which are required to assess not only the performance but also the nuclear survivability of the weapon system). There will be five RDT&E flight tests. The development test laboratories at Vandenberg AFB and Seattle will be operational. They will be developing and validating various electrical and software modifications required for Peacekeeper. The costs are based on contractor and program office estimates. The cost estimate category is III, Budgetary. The program is in FSD and uses a combination of competition and sole sourcing for contracting. The last comprehensive review of the estimate was June 1984. The FY 1986 Military Construction Program will consist of one project each at Ellsworth, Hill, and Offutt AFBs and three projects at F.E. Warren AFB. Design is approximately 25% complete. Small ICBM and Hard Mobile Basing. Competitions will be conducted to prepare for final down-selections to one HML contractor and one contractor each for the three propulsion stages. In addition, preparations will be accomplished to down-select from the three current alternate inertial navigation system (AINS) contractors. Competition with the baseline inertial navigation system contractor will be maintained to the maximum extent possible within resources available so that AINS can be evaluated on Minuteman test bed flights in FY 1987. Analyses and tests will continue during the year to allow further narrowing of Small ICBM concepts and baselining of functional requirements in a weapon system specification. Sled tests of inertial guidance systems will be conducted, as well as full-scale motor and case burst tests. Subscale tests will evaluate ruggedness of the propulsion stages, integration of the stages/interstages, and staging events. Ordnance, physical security, and thrust vector actuator development tests will continue. Large scale mobile tests and large scale blast tests of the representative Hard Mobile Launcher will be conducted. The Systems Requirements Analysis (SRA) process will also begin to support Full-Scale Development (FSD) design specifications. ICBM

Follow-on Basing Technologies. Design, construction of facilities, and fabrication of mechanical hardware for the second large size blast test (which includes mechanical systems) will continue. A subsize blast test featuring direct-induced high explosive testing will validate the procedures to be used in the full size test. Full size validation tests for advanced egress systems will be completed and decisions made to include concepts in follow-on development. Deep basing activities initiated in FY 1985 will continue. Emphasis will be placed on development and planning for a one-fifth scale pre-prototype missile launch demonstration in FY 1988 and a pre-prototype rapid boreout demonstration test in FY 1989.

(4) (U) Program to Completion: Peacekeeper. Initial operational capability (IOC) will be achieved in late 1986 with the deployment of 10 missiles in Wyoming. The remaining 90 missiles will be deployed in silos during 1987-1989. The Research, Development, Test and Evaluation (RDT&E) projection shows that FY 1989 will be the last year requiring RDT&E funds. The FY 1987 Military Construction Program will consist of three projects at Hill AFB and three projects at F.E. Warren AFB. The FY 1988 Military Construction Program will include four projects at Hill AFB and four projects at F.E. Warren AFB. Design has not yet started. Small ICBM and Hard Mobile Basing. Full-scale development will begin in FY 1987 with single designs for the overall weapon system and all subsystems. Flight tests could begin in late 1988, leading to IOC in 1992. If development of alternative subsystems or technologies progresses sufficiently, the results could be incorporated into the baseline design when justified by cost or by the Soviet threat. Dual sources will be maintained where practical. ICBM Follow-On Basing Technologies. The second full-size test for the hard silo will occur in 1988. If the option for hard silo basing is exercised, full-scale engineering development will begin in early FY 1987. The deep basing program is planning for full-scale launch and egress demonstrations in FY 1992 to support a FSD decision in CY 1993.

C. (U) Major Milestones:

Peacekeeper Milestones	Dates
(1) (U) Strategic Air Command Required Operational Capability 16-71, Advanced ICBM System	February 1972
(2) (U) Defense Systems Acquisition Review Council I	March 1976
(3) (U) Validation Phase Initiated	October 1976
(4) (U) Defense Systems Acquisition Review Council IIa	December 1978
(5) (U) Defense Systems Acquisition Review Council IIb	March 1979
(6) (U) Defense Systems Acquisition Review Council IIc	July 1979
(7) (U) Defense Systems Acquisition Review Council IId	July 1979
(8) (U) Full-Scale Development Initiated	September 1979
(9) (U) System Design Review	September 1980
(10) (U) President's Strategic Modernization Program Announced	October 1981
(11) (U) Scowcroft Commission Recommendation	April 1983
(12) (U) Presidential Decision	April 1983

(13) (U) First Flight Test	June 1983
(14) (U) Nuclear Hardness and Survivability Review Group Convened	October 1983
(15) (U) Production Start	January 1984
(16) (U) Initial Operational Capability	December 1986
(17) (U) Full Operational Capability	December 1989

Small ICBM and Hard Mobile Basing Milestones	Dates
(1) (U) Scowcroft Commission Recommendation	April 1983
(2) (U) Deputy for Small Missile Established	May 1983
(3) (U) Schriever Group Recommendation	September 1983
(4) (U) Nuclear Hardness and Survivability Review Group Initiated	October 1983
(5) (U) Pre-Full-Scale Development Start	October 1984
(6) (U) Full-Scale Development Start	Late 1986

ICBM Follow-On Basing Technologies Milestones	Dates
(1) (U) Initial Nuclear Environment Definition	Mid-1983
(2) (U) Initial Concept Phase for Deep Basing Completed	September 1983
(3) (U) Nuclear Hardness and Survivability Review Group Convened	October 1983
(4) (U) OSD Deep Basing Requirements Study Completion	March 1984
(5) (U) First Egress Subsystem Demonstration for Hard Silo	February 1985
(6) (U) Large-Scale System Validation for Hard Silo	Late 1986

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Ballistic Missile Office (BMO), Norton AFB, CA, is the Air Force Systems Command Program Manager for developing the Peacekeeper Weapon System. BMO is also the Responsible Test Organization for DT&E. The Air Force Operational Test and Evaluation Center is responsible for Initial Operational Test and Evaluation (IOT&E). The Strategic Air Command will operate Peacekeeper and, jointly with the Air Force Logistics Command, will be responsible for maintaining the system. Principal development contractors are: Aerojet General Corp., Avco Systems Division, GTE Sylvania, Hercules Aerospace Corp., Honeywell Inc., Martin Marietta Corp., Northrop Corp., Rockwell International - Autonetics Div., Rockwell International - Rocketdyne, TRW, The Boeing Company, Morton-Thiokol Inc., Westinghouse Electric Corp., General Electric Co., and Logicon Inc.

(U) The DT&E program to date has concentrated primarily on the development and test of missile subsystems with six successful flight tests. Testing of basing systems concepts for Peacekeeper in Minuteman silos is just beginning. DT&E testing reported herein summarizes activity through the first six tests of Peacekeeper Flight Test Missiles (FTM) in 1983 and 1984.

(U) A tot l of 20 DT&E/IOT&E test flights from the Western Test Range at Vandenberg AFB (VAFB), CA, have been scheduled. Flight tests will continue after deployment through 108 follow-on operational test and evaluation flights conducted by the Strategic Air Command. The flight test articles are configured with test reentry vehicles and an instrumentation and flight safety system. The test and evaluation objectives are to evaluate missile performance during powered flight, assess the capability of the advanced inertial reference sphere guidance and control unit, evaluate ground system interface, test post-boost vehicle footprint, and determine time of flight performance capabilities. The first eight launches will be from a test pad to evaluate the missile. To date, there have been six successful flight tests and the seventh flight test missile is in assembly and checkout at VAFB.

(U) The test data thus far have provided confidence that the required weapon system performance can be met within the identified state-of-the-art technologies at a reasonable cost. Additionally, this testing has provided hardware design data which will assure more comprehensive specifications and a more realistic estimate of life cycle system costs. Prior to the flight test program, ground testing evaluated areas of design risk in guidance, motor and nozzle, reentry system, launcher, Command, Control and Communication (C^3), ground power, physical security system, and nuclear hardness and survivability. Contractor test facilities, Arnold Engineering Development Center (AEDC), Tullahoma, TN; Rocket Propulsion Lab, Edwards Air Force Base, CA; Nevada Test Site, Mercury, NV; Holloman Air Force Base, NM; Kirtland Air Force Base, NM; and Vandenberg AFB, CA, have been used for the testing.

Development Test and Evaluation (DT&E) on Guidance and Control (G&C) during Full-Scale Development (FSD) is currently emphasizing performance (functional and accuracy) testing of missile subsystems in a benign flight environment. Flight Missile Guidance and Control Sets (MGCS) for the Flight Test Missiles (FTM) 1 through 6 tests

completed acceptance testing at the contractor and were delivered to Vandenberg AFB, where they successfully completed pre-launch and flight test. Preliminary data analysis indicates very good performance by all six of the guidance systems. The mean point of impact (down, cross) in feet for each of the first five flight tests are as follows: [ ] Test range accuracy is under [ ]

(U) In-plant integration of the guidance and control (G&C) subsystem with other missile subsystems was completed in September 1982. Efforts have been concentrated on flight-proof testing, and calibration and alignment evaluation. Flight-proof testing consisted of missile guidance and control (MGCS)-level vibration, shock, and temperature/altitude testing. This was completed in July 1983. Remaining electromagnetic compatibility and TEMPEST testing was completed in early March 1984. Calibration and alignment tests to evaluate the research and development mechanization and to identify potential improvements for the operational mechanization were carried out in fiscal year (FY) 1983 and continued in FY 1984. Variations to the baseline trajectory and alternate trajectories were investigated. Tests required to identify potential improvements to the MGCS operational mechanization were completed in FY 1984.

(U) FY 1985 and FY 1986 Full-Scale Development (FSD) testing activities will include flight tests qualification tests, and interface tests. Flight testing of the guidance system using operational ground and flight computer programs will begin with FTM-9 and continue on subsequent flights. New routines for calibration and alignment will also be tested during this portion of the flight test program. The mechanization and accuracy of these new routines have been verified during sled test environmental runs performed at Holloman AFB in FY 1984 and early FY 1985. Additional sled test runs are planned in mid-FY 1985 to demonstrate the mechanization and accuracy capabilities of the actual flight computer programs. Activ es to reduce the time required for the calibration and alignment sequence will continue in FY 1985. Radiation and mechanical qualification tests will be performed on the missile electronics and computer assembly (MECA), the inertial measurement unit (IMU) and the MGCS. G&C subsystem interface testing with basing equipment begins in FY 1985 and continues into FY 1986. Preliminary tests will be performed at contractor facilities with final checkout to be accomplished at Vandenberg and Francis E. Warren AFBs.

(U) Stage I is a solid propellant rocket motor that is 28 feet long, 92 inches diameter, and weighs approximately 107,000 pounds. It has a thrust vector actuation system that can vector the nozzle up to six degrees. Stage I boosts the missile to about 75,000 feet following cold launch from the canister.

(U) Stage I has successfully completed four sea level flight proof test (FPT) motor firings at the Morton Thiokol test facility near Brigham City, UT. Review of the FPT data revealed that nozzle slew rate below 45°F did not meet the minimum value specified in the Prime Item Development Specification (PIDS). The cause was attributed to adverse physical properties of the flex bearing rubber resulting in a greatly increased nozzle torque requirement at low temperatures and induced stresses. The FPT program was completed upon the successful firing of FPT-5 in October 1983.

(U) Three Stage I pre-qualification (PQ) tests have been successfully conducted at sea level conditions at Morton Thiokol. The purpose of the PQ test series is to verify final readiness for production and qualify second source vendors and materials. PQ-1 was fired on 7 June 1984 to evaluate performance at 55°F with a 3-D carbon-carbon nozzle throat entrance using domestic materials (vice foreign materials which have been used for all previous nozzle throat entrances) and second source thrust vector actuation system components. Motor performance was within predicted limits with a motor burn time of 56 seconds. PQ-3 was fired on 16 August 1984 to evaluate ballistic performance at 65°F with second sources nozzle exit cone materials. Motor performance was within predicted limits with a motor burn time of 56 seconds. PQ-2 was fired on 15 November 1984 to evaluate ballistic performance at 95° with second source nozzle materials and following pre-firing motor temperature and humidity cycling. Motor performance was within predicted limits with a motor burn time of 52 seconds.

(U) Stage II is a solid propellant rocket motor that is 18 feet long, 92 inches diameter, and weighs approximately 60,000 pounds. It has a thrust vector actuation system that can vector the nozzle up to six degrees, and an extendible nozzle exit cone (ENEC) that is deployed after stage ignition to increase performance at operating altitudes. Stage II boosts the missile from approximately 75,000 to 300,000 feet.

(U) Stage II has completed four flight proof tests (FPT) motor altitude firings in the J-4 test cell at Arnold Engineering and Development Center (AEDC). FPT-1 fired successfully, followed by the FPT-3 failure. The failure mode was identified and solved by trimming propellant in the forward and aft boot areas to relieve restricted gas flow. DS-7A and DS-7B were successfully tested at sea level at Aerojet Strategic Propulsion Company (ASPC) verifying a hand-trimmed grain to be used on first flight. DS-10 and DS-10A were also successfully tested at ASPC, verifying the as-cast grain configuration and a new liner system. The firing of DS-8 at AEDC demonstrated the adequacy of the alternate low denisty carbon (LDC) configuration extendible nozzle exit cone (ENEC) cone material. FPT-4 successfully completed the FPT motor test series at AEDC and verified the grain at cold temperature. The sixth flight test (1 October 1984) was successfully conducted at Vandenberg AFB, verifying the as-cast grain configuration.

(U) Three Stage II pre-qualification (PQ) tests have been successfully conducted. PQ-1 was fired on 9 August 1984 in the J-4 test cell at AEDC to evaluate ballistic performance at 60°F and simulated altitude conditions following pre-firing motor temperature and humidity cycling. Motor performance was within predicted limits with a motor burn time of 60 seconds. PQ-2 was fired on 19 October 1984 at ASPC to evaluate ballistic performance at 72°F and sea level conditions with a motor case, flexseal, and nozzle manufactured by Aerojet. These components were previously procured from subcontractors (case - Brunswick; flexseal - HITCO; nozzle - Kaiser). Motor performance was within predicted limits with a motor burn time of 57 seconds. PQ-3 was fired on 6 December 1984 in the J-4 test cell at AEDC to evaluate ballistic performance at 95°F and simulated altitude conditions with a shortened ENEC and following pre-firing motor temperature and humidity cycling. Motor performance was within predicted limits with a motor burn time of 56 seconds. PQ-3 completed the Stage II pre-qualification test series.

(U) Stage III is a solid propellant rocket motor that is 90 inches long, 92 inches diameter, and weighs approximately 17,000 pounds. It has a thrust vector actuation system that can vector the nozzle up to three degrees, and an ENEC that is deployed after stage ignition to increase performance at operating altitudes.

(U) Stage III has completed five flight proof test (FPT) motor altitude firings in the J-5 test cell at Arnold Engineering and Development Center (AEDC). This successfully completes the Stage III FPT program. Hercules has delivered FTM-1 through FTM-10 in support of Peacekeeper flight tests to be conducted at Vandenberg AFB (VAFB).

(U) Two Stage III pre-qualification (PQ) tests have been successfully conducted at sea level conditions at the Hercules test facility at Tekoi, UT. PQ-1 was fired on 4 May 1984 to evaluate ballistic performance with second source propellant ingredients. PQ-2 was fired on 25 May 1984 to evaluate ballistic performance at 72° with an alternate case internal insulation process.

(U) One Stage III qualification test was successfully conducted in the J-5 test cell at AEDC on 17 November 1984. Qualification tests verify production tooling and processes. This firing evaluated ballistic performance at 90°F and simulated altitude. Motor performance was within predicted limits with a motor burn time of 66 seconds.

(U) Stage IV is a liquid propellant stage with one axial rocket engine and eight altitude control thrusters. Stage IV is 42 inches long, 92 inches diameter, and weighs approximately 2,500 pounds. The axial engine can be vectored up to 15 degrees.

(U) The Stage IV FPT program for both tank designs was completed by the successful firings of FPT-1, FPT-2, FPT-3 and FPT-3R1 (screen tank design). These tests successfully demonstrated flight proof design and the flight worthiness of the system. All flights of Stage IV to date have been nominal.

(U) The ordnance system includes the Flight Termination Ordnance System (FTOS), which provides a command destruct capability for flight test missiles, and the Ordnance Initiation System (OIS), which includes the hardware used to initiate motor igniters, gas generators, and stage separation devices. The ordnance system has successfully completed both FTOS qualification and OIS flight proof testing. FTOS and OIS deliveries for flights 1-10 have been accomplished.

(U) The reentry system flight proof testing has been completed successfully at the subassembly and system level. Reentry system performance in flight tests 1 through 6 was nominal in all cases. The electronics package for the reentry system has been modified to accommodate both operational MK-12A and MK-21 reentry vehicles. Flight proof testing for the MK-21 has been conducted during FY 1984, and qualification testing will be conducted during FY 1985. MK-21s were flown on FTM-5 and FTM-6 with good results.

(U) The only major subsystem that will not be completely tested as an entity is the nuclear warhead. Safety and treaty agreements require that it be tested in segments, both on the ground and in flight, in ways that will never produce a full yield. The Department of Energy (DOE) will manage this testing in the same manner that they test other nuclear weapons. The DOE will certify yield and reliability. These figures will be used by the military along with other test data to assess weapon system effectiveness.

(U) A canister/launcher full-scale development and evaluation test series began in January 1982 on the canister assembly at the Nevada Test Site. This initial series of the Canister Assembly Launch Test Program (CALTP) consisted of four test vehicle launches and identified problems with canister-to-missile pads sticking to the missile which resulted in pad redesign. This testing also resulted in improved design of the Launch Eject Gas Generator, and confirmation of the redesign of the missile umbilical group. Weapon System Test T-14 (October 1982) determined canister-to-missile separation ordnance shock, in-canister launch dynamics and exit tip-off rates. Corrective action for the configurations including ones with Mylar film and waffle-type construction was accomplished during the last CALTP effort. Testing continued, and the final operational design will consist of a Kevlar cloth interface with the missile.

(U) A second series of CALTP launches is scheduled for May 1984 through December 1985. The first two tests in this series helped define the gas dynamics conditions. The series of tests will assess the delayed retention and release system which permits delayed release of canister-to-missile pads and the launch seal. Beginning with the third test in this series a steel canister will be substituted for the current composite design. In addition to the gas dynamics of Peacekeeper launches from Minuteman silos, performance of the air elevator and launch ejection from the steel canister will be evaluated.

(U) Testing of transportation and handling (T&H) equipment developed to support DT&E/OT&E launches at Vandenberg AFB (VAFB) was performed at the manufacturer's home plant. The qualification and acceptance testing for the large items, which needed full-up missile components, like the canister rotation and missile assembly fixture, stage erection platform, and missile assembly work platform was accomplished at VAFB using either the mass simulated canisterized missile or the individual ground test missile Pathfinder stages and reentry system. The equipment successfully supported the transport to VAFB, stage processing, assembly, transport to the launch facility and launch of FTM-1 through FTM-6. This same equipment will continue to support future tests.

(U) New T&H equipment, such as emplacer and carriages, is being assembled to support unique Peacekeeper in Minuteman silo program requirements, including Pathfinder assembly in selected Minuteman silos at VAFB and future launches. Prior to the emplacer delivery to VAFB in February 1985 for the integrated test program, sub-element and assembled components will be tested at the manufacturer's plant. These tests will functionally demonstrate the erection, roll transfer, and hoist operations.

(U) The Environmental Control System (ECS) will be tested consistent with the Peacekeeper modifications required of the Minuteman silos. A development, qualification, flight test support, and deployment kit proofing program is planned. Development tests supported a Preliminary Design Review in March 1984. Qualification and flight tests support a November 1984 Critical Design Review. Kit proofing tests support the production, Functional Configuration Audit, and Physical Configuration Audit. Because of basing in existing Minuteman silos, no underground testing or hardness testing is required for the environmental control system (ECS).

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

(U) A nuclear hardness and survivability test program of missile materials, components, and subsystems has been ongoing since 1977, when external protection material testing began. This program was completed in 1984. The underground test program consisted of Miners Iron (1980) tests on materials for booster and reentry system, Huron Landing (1982) tests on missile structures and shroud, and will continue with MK 21 reentry vehicle testing on Midas Myth (1984), Misty Rain (1985), and Mighty Oak (1985). In 1983 (January-June) an Electromagnetic Pulse (EMP) test of an inert Peacekeeper missile without avionics was carried out at the Advanced Research Electromagnetic Pulse Simulation (ARES) facility in NM. Also in 1983, the light-initiated high explosive test was run on Stage IV.

(U) In support of the Peacekeeper in Minuteman Silo System Development, there are a large number of tests planned for the late 1984-1985 time period. An electrical surge arrester vault test is planned for EMP effects; additionally, a number of operational support equipment (OSE) basing components and subsystems will be tested for EMP, radiation, and/or mechanical environments. These tests support the Peacekeeper OSE basing component design reviews.

(U) First Flight (17 June 1983) data review revealed several anomalies in Stage I and Stage II.

(U) Stage I data revealed an excessively long (440 versus 250 milliseconds expected) time for chamber pressure to build up and a long tail-off time. The cause of the ignition delay was excessive moisture on the propellant grain. The long tail-off was due to a casting anomaly. To eliminate the above anomalies the Launch Eject Gas Generator (LEGG) was modified and an igniter moisture protection cover was incorporated. The corrected pressure rise time has proven highly repeatable on all flights and is within system requirements. The Stage I prime item development specification (PIDS) is being revised to reflect the slower time. Casting processes were reviewed, the source of the anomaly identified, and strict process controls levied to prevent recurrence.

(U) Stage II data revealed an Extendible Nozzle Exit Cone (ENEC) anomaly which was attributed to an improper locking device on the ENEC actuation system. A fix was implemented on FTM-2, to incorporate sufficient locking force. Stage II ENECs have performed satisfactorily on all subsequent missions.

(U) The second flight test (14 October 1983) with the modified LEGG was conducted at Vandenberg AFB (VAFB) revealing normal Stage I ignition and Stage II ENEC operation.

(U) The third flight (20 December 1983) experienced an ENEC failure at approximately 37 seconds into Stage III operation. The failure was attributed to loss of the heat shield that protects the ENEC deployment actuator from heat of the cone. Subsequently, Hercules has added additional insulation to the actuator and has strengthened the heat shields to prevent loss. These corrections were incorporated on FTM-4 and later flights.

(U) Fourth flight (30 March 1984) was normal and experienced no ENEC problems.

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

(U) The fifth flight (15 June 1984) was the first flight to involve the deployment of a MK-21 reentry vehicle. This flight test was successful.

The sixth flight test (1 October 1984) was the first flight to carry exclusively MK-21 reentry vehicles. All six were successfully deployed. [

(U) Tests on the following subsystems have been scheduled, started, and/or completed as shown:

Test	From	To
Propulsion, Full Scale (Single Stage)	January 1980	October 1984
Flight Termination Ordnance System	August 1980	October 1984
Flight Software	January 1981	December 1982
Advanced Inertial Reference Sphere Sled	June 1981	September 1981
Advanced Inertial Reference Sphere Bench	September 1981	September 1982
Reentry System Shock and Vibration	October 1981	October 1981
Missile Electronics and Computer Assembly	November 1981	December 1982
Reentry System Shroud Fly-Away	December 1981	December 1981
Canister Assembly Launch Test Program	January 1982	December 1985
Modal Survey	February 1982	April 1982
Guidance and Control Integration	March 1982	September 1982
Reentry Systems Stiffness	March 1982	March 1982
Vandenberg Air Force Base Pathfinder	June 1982	May 1983
Reentry System Flight Proof	June 1982	March 1983
Missile Assembly Building/Launcher Handling	September 1982	June 1983
Guidance and Control Environmental	November 1982	January 1984
Electromagnetic Pulse/Electromagnetic Interference/ Electromagnetic Compatibility	January 1983	June 1984
Vandenberg Air Force Base Pad Launches (6)	June 1983	October 1984
Full-Scale Development Sled	July 1983	June 1984
Reentry System Deployment Module Electronics (DME) Compatibility	November 1983	December 1983
Reentry System Qualification (Without DME)	November 1983	June 1984
Deployment Module Electronics Qualification	February 1985	September 1985
Deployment Module Electronics Radiation	January 1984	June 1984
Missile Electronics and Computer Assembly Radiation/System-Generated Electromagnetic Pulse Test	February 1984	June 1985

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

Test	From	To
Reentry Vehicle Flight Proof	July 1984	October 1984
MK-21 Impulse Test	October 1984	October 1984
Inertial Measurement Unit Radiation Qualification Test	July 1985	January 1986
MK-21 Blast Test	December 1984	December 1984
Emplacer, Functional	December 1984	May 1985
Reentry Vehicle Qualification	April 1985	October 1985
Inertial Measurement Unit Limit Radiation Test	June 1985	April 1986
MK-21 Fuze Radiation	July 1985	July 1985
Missile Guidance and Control Mechanical Qualification Test	April 1985	September 1985
Missile Guidance and Control Set Radiation	July 1985	April 1986
Missile Electromagnetic Pulse Test	January 1986	June 1986
Missile Electronics and Computer Assembly Mechanical Qualification Test	March 1985	September 1985
Inertial Measurement Unit Mechanical Qualification Test	June 1985	February 1986
Missile Guidance and Control Radiation Qualification Test	June 1985	April 1986

2. (U) Operational Test and Evaluation (OT&E): This is a combined DT&E/OT&E program, with Air Force Operational Test and Evaluation Center (AFOTEC) managing the OT&E portion. OT&E objectives have been fully integrated with DT&E objectives to reduce schedule and cost impacts. An AFOTEC test team has been formed which includes personnel from Strategic Air Command (SAC), Air Force Logistics Command (AFLC), Air Force Communications Command (AFCC), Air Training Command (ATC), and AFOTEC. All test scenarios will be structured to accommodate the objectives of the combined test program. The test approach will be a step-by-step integration of each major element of the system into flight and ground tests, which commenced with the Pathfinder activities in September 1982. A program of 20 launches with evolution from mainly DT&E- to OT&E-oriented objectves is planned. Flight tests will evolve from a pad launch configuration to operationally representative silos at Vandenberg AFB, California. The operational effectiveness and suitability of the system will be evaluated in an increasingly representative environment. Early engineering model test results will be updated as preproduction and production equipment becomes available. The first three test missiles were successfully launched on 17 June, 14 October, and 20 December 1983. The fourth test missile was launched on 30 March 1984: 10 reentry vehicles were carried for the first time, and all were successfully deployed. The fifth test missile was launched 15 June 1984: first flight test of MK-21 reentry vehicle. The sixth test missile was launched on 1 October 1984. All six MK-21 reentry vehicles were successfully deployed.

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

3. (U) System Characteristics: The two goals and thresholds established for the Peacekeeper In Minuteman Weapon System by the Program Management Directive are the Mission Effectiveness Factor (MEF) and accuracy expressed as Circular Error Probable (CEP).

(U) MEF is defined as the product of launch (countdown) and flight reliability, weapon system availability, and targeting efficiency.

The MEF goal is [ ] and the threshold is [ ] As of December 1984, the MEF projection is [ ]

(U) Launch (countdown) and flight reliability is defined as the probability that an available missile system will, disregarding the effects of enemy action, respond to a valid launch command and will successfully complete launch and flight, resulting in the detonation of a given warhead within 3.5 times the circular error probable requirement. During the DT&E/OT&E program, the operational launch (countdown) and flight reliability will be assessed using flight testing and applicable ground testing such as motor static testing, launch system testing, command, control and communication testing, and guidance and control testing. It is anticipated that failures will occur during the early phase of the flight test program. Causes of the failures will be corrected through a reliability improvement program. Test data will be reviewed after sufficient testing has been accomplished to verify the effectiveness of the corrective action. The limited data base available at Initial Operational Capability (IOC) will not support a high level of confidence in the assessed launch (countdown) and flight reliability value. Strategic Air Command Follow-on Operational Test and Evaluation results accumulated after IOC will increase confidence in this assessment.

(U) Weapon system availability is defined as the percentage of a missile force, under the jurisdiction of the using command and committed to the wartime mission, which is capable of commitment to the launch sequence at any random point in time. Prior to IOC, availability predictions will be based upon a probabilistic availability model. Simulations will be used as necessary to verify the availability prediction and to generate inputs to the model for variables such as spares availability that are not conducive to probabilistic solution. Subsequent to IOC, actual field alert and flight experience as reported by the Strategic Air Command will be the basis for availability assessments.

(U) Targeting efficiency is defined as the ratio of the number of targets in a reference target list to the number of reentry vehicles flown to achieve 100% coverage of that same target list. The targeting efficiency assessment will be continually updated from the missile system engineering studies to track the performance of the Peacekeeper missile during the DT&E/OT&E program. Missile parameters, such as subsystem weights and motor specific impulse may vary during development and test. If so, this will influence missile performance against various target structures.

(U) Accuracy is a measure of the miss distance for a reentry vehicle that has been delivered to the target area. Accuracy is expressed as circular error probable, which is defined as the radius of a circle centered on the aim point within which 50% of the reentry vehicles are expected to be located at airburst or impact.

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

(U) The evaluation of accuracy is a continuing process which begins with the design of the weapon system and continues throughout the life of the flight test program. Initially, error budgets are established at the subsystem level to derive an accuracy budget at the weapon system level. The major subsystems for categorizing accuracy include guidance and control, targeting, geodetic and geophysics and reentry. Under guidance and control is included inertial measurement unit (including gyroscopes and accelerometers), hardware errors, ground program errors, flight program errors, and certain elements in the deployment sequence. Reentry subsystem errors include the reentry vehicle and certain elements of separation. Targeting and geodetic and geophysical evaluations are primarily accomplished by computer simulations.

(U) During the Peacekeeper In Minuteman test program, flight test results will be used to validate the engineering estimates. Confidence in achieving the system accuracy goal will increase during DT&E/OT&E ground and flight testing. A mature system accuracy assessment will be completed approximately 3-5 years after Peacekeeper In Minuteman Weapon System initial operational capability (IOC).

The operational accuracy goal for the mature Peacekeeper system is [ ] at a north-firing range of [ ] Current engineering estimates and flight test data indicate this goal will be achieved.

The Peacekeeper missile has the following additional system characteristics:

1. The Peacekeeper will weigh 195,000 pounds.

2. The Peacekeeper will deliver a payload of up to 10 MK-21 reentry vehicles.

3. The Peacekeeper will have a range of [ ] with an accuracy of [ ]

4. The system will have a remote fault detection capability to isolate 95 percent of all launch critical faults to a line replacement unit on Peacekeeper unique equipment.

5. The system will provide [ ]

4. (U) Current Test and Evaluation (T&E):

T&E Activity (at 1983)

Event	Planned Date	Actual Date	Remarks
Test & Evaluation master plan issued	N/A	Not Yet approved	Document revised to reflect basing decision. Provides executive overview of weapon system testing.

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

Second flight	2nd Qtr CY 1983	October 1983	Slipped to allow turn-around from first flight launch. All test objectives were satisfied.
Roadability	4th Qtr CY 1983	December 1983	Demonstrate capability to move Peacekeeper vehicles over deployment area roads during winter weather conditions. Successful movement of transporter was demonstrated.
Third flight	1st Qtr CY 1983	December 1983	Expand flight envelope by varying range and target footprint for subsequent flight tests. Failure of third-stage extendible nozzle led to fuel depletion in Stage IV before all reentry vehicles (RVs) were deployed. Four of eight RVs were deployed successfully.

T&E Activity (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
Start modification of first Minuteman flight silo (Vandenberg AFB) to support Peacekeeper silo testing	1st Qtr CY 1984	December 1983	Ninth and subsequent flight tests to be silo launched. Silo will support ground testing in addition to flight launches.
Fourth flight test	2nd Qtr CY 1984	March 1984	Full complement of 10 reentry vehicles carried for the first time. All 10 were deployed successfully.
Fifth flight test	3rd Qtr CY 1984	June 1984	First flight test of MK-21 reentry vehicle. All six vehicles, including one MK-21, were successfully deployed.
Phase II roadability test	2nd Qtr CY 1984	July-August 1984	Demonstrate transporter capability to operate in deployment area during summer weather conditions.
Sixth flight test	3rd Qtr CY 1984	October 1984	First flight test to deploy only MK-21 reentry vehicles--MK-21 designated for Peacekeeper. All six RVs were successfully deployed. Subsequent flight tests will carry only MK-21s and will assess missile performance over full employment capabilities.

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Peacekeeper

T&E Activity (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
Seventh flight	1st Qtr CY 1985		Demonstrate MK-21 performance on a lofted trajectory.
Eighth flight	2nd Qtr CY 1985		Demonstrate MK-21 reentry vehicle (RV) performance on a nominal trajectory to a longer range target area.
Ninth flight	3rd Qtr CY 1985		Demonstrate booster and MK-21 RV performance in a stressed environment to an extended range target area. Initial evaluation of silo launch capsbility and environment and control system interfaces.

Budget Activity: 3, Strategic Programs
Program Element: 64312F, Small Intercontinental Ballistic Missile

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Ballistic Missile Office (BMO), Norton AFB, CA, is the Air Force Systems Command Program Manager for developing the Small Intercontinental Ballistic Missile (Small ICBM) Weapon System. BMO is also the Responsible Test Organization for DT&E. The Air Force Operational Test and Evaluation Center is responsible for initial Operational Test and Evaluation (OT&E). The Strategic Air Command will operate the Small ICBM and, jointly with the Air Force Logistics Command, will be responsible for maintaining the system. Principal development contractors are: Aerojet General Corp., AVCO, GTE Sylvania, Hercules Aerospace Corp., Honeywell Inc., Martin Marietta Corp., Northrop Corp., Rockwell International - Autonetics Div., TRW, The Boeing Company, Litton Inc., McDonnell-Douglas Astronautics, Inc., Morton-Thiokol Inc., General Electric Co., United Technologies - Chemical Sys. Div., McDonnell-Douglas Corp., General Dynamics/Convair Div. and Bell Aerospace/Textron.

(U) The DT&E program to date has concentrated primarily on the development of test plans and concepts for missile subsystems. Testing concepts planning for Small ICBM is just beginning.

(U) A total of 22 test flights from the Western Test Range at Vandenberg AFB (VAFB), CA, and the Eastern Test Range at Cape Canaveral, FL, have been planned. These flight tests begin during Development Test and Evaluation/Initial Operational Test and Evaluation and continue through approximately 108 follow-on Operational Test and Evaluation flights conducted by the Strategic Air Command. The flight test articles will be configured with a test reentry vehicle and an instrumentation and range safety system. The test and evaluation objectives are to evaluate missile performance and to assess the capability of the advanced inertial reference sphere guidance and control units to achieve accuracy and reliability, including ground system interface, stage performance, guidance and control accuracy, post boost vehicle footprint, and time of flight performance capabilities. The first seven launches will be from a test pad to evaluate the missile. The remaining OT&E flights will be launched from operational launchers to evaluate missile and Hard Mobile Launcher (HML) interface and launch parameters.

(U) This testing will provide hardware design data which will assure more comprehensive specifications and a more realistic estimate of life cycle system costs. The test program will initially evaluate areas of design risk in guidance, motor and nozzle, reentry system, operational launcher, Command, Control and Communications (C^3), ground power, physical security system, and nuclear hardness and survivability. Contractor test facilities, Arnold Engineering Development Center (AEDC), Tullahoma, TN; Rocket Propulsion Lab, Edwards Air Force Base, CA; Nevada Test Site, Mercury, NV; Holloman Air Force Base, NM; Kirtland Air Force Base, NM; and VAFB, CA, are to be used for most of the testing.

(U) DT&E on Guidance and Control is currently being planned in two parts. The first part occurs during Pre-Full-Scale Development (Pre-FSD). Competing Alternate Inertial Navigation Systems (AINS) will be evaluated by means of sled test runs at Holloman AFB. The primary purpose of these tests will be calibration and alignment, functional, and accuracy testing of the AINS to support a down-selection in October 1986. Following the first

down-selection, the remaining AINS plus the baseline navigation system, the Modified Advanced Inertial Reference Sphere (Mod AIRS) will be flight tested aboard a Minuteman III (MM III) missile. These tests will evaluate the relative performance of the various navigation systems in a flight environment. The MM III flight tests will support a second Alternate Inertial Navigation System (AINS) down select in October 1987.

(U) The second part of DT&E occurs during Full-Scale Development (FSD). During this phase, testing on the entire Missile Guidance & Control Set is planned to evaluate the performance (functional and accuracy) of missile subsystems to a benign flight environment. All airborne vehicle and ground support equipment will be tested prior to flight during Pathfinder testing at Vandenberg AFB (VAFB). Ground testing will culminate in an end-to-end polarity test of the missile system.

(U) The one year long solid stage propulsion concept definition program is nearing completion. During this phase, contractors developed and tested solid propellants, developed preliminary stage designs, identified areas requiring technology development, and provided inputs to the Small ICBM business strategy. Competition for Pre-Full-Scale Development of the stages is being conducted in Winter 1984/1985.

(U) The program office has developed a business plan for the Ordnance Initiation System and Flight Termination Ordnance System. Competition will be conducted in Spring 1985.

(U) The only major subsystem that will not be completely tested as an entity is the nuclear warhead. Safety and treaty agreements require that it be tested in segments, both on the ground and in flight, in ways that will never produce a full yield. The Department of Energy (DOE) manages this testing in the same manner that they test other nuclear weapons. The DOE will certify yield and reliability. The Small ICBM will use the MK-21/MOD-5F warhead developed by the Peacekeeper program.

(U) New missile handling equipment, such as emplacer and carriages, will be developed to support the Small ICBM program including Pathfinder assembly at VAFB and future launches. Prior to the emplacer delivery to VAFB for the integrated test program, subelement and assembled components will be tested at the manufacturer's plant. This will functionally demonstrate the erection, roll transfer, and hoist operations.

(U) A nuclear hardness and survivability program on missile materials, components and subsystems has been an ongoing effort on the Peacekeeper program. Much of this data will be transferable to the Small ICBM program. For the Underground Test Programs, the MK-21 reentry vehicle (RV) was tested on Midas Myth (1984), Small ICBM materials will be tested on Misty Rain (1985), additional materials and fiber optics on Mighty Oak (1985), propellant on Middle Note (1986), and further experiments on Mineral Quarry (1987) and Hunters Trophy (1989). Small ICBM missile electromagnetic pulse (EMP) test will be conducted in 1990, relying on Peacekeeper experience from 1983 and 1986 tests.

(U) A nuclear hardness and survivability program will be conducted on the Hardened Mobile Launcher (HML). In addition to parts, components, end item and subsystem nuclear environment testing, systems level testing (including

missile) is being planned for the technology areas of electromagnetic pulse (EMP), nuclear radiation and blast/shock. Phase testing of a 1/6 scale hard mobile launcher (HML) model (19' shock tube) was conducted during September - November 1984.

(U) For the hard silo basing of the Small ICBM program, a nuclear hardness and survivability program will be conducted testing parts, components, end items and subsystems as well as possible systems tests for electromagnetic pulse (EMP) and blast/shock at the weapon systems levels. Sub Size I (50" diameter silo) was tested in July 1984 and retested in October 1984. Large size silo (150" diameter) test is scheduled for March 1985. Other silo tests are scheduled throughout 1985 and 1986.

2. (U) System Characteristics: Because the weapon system has many elements that contribute to its effectiveness, and because management tradeoffs between these elements are necessary to identify the most cost-effective combination, Small ICBM program thresholds and goals have been established at the weapon system level.

(U) The Small single warhead missile is defined by the Program Management Directive as:

1. Weighing no more than 13,610 KG.

2. Having a throw weight of approximately 454 KG at a nominal range of at least 11,110 KM.

3. Being compatible with mobile or fixed deployment.

4. Having a specified accuracy expressed as Circular Error Probable.

(U) Accuracy is a measure of the miss distance for a reentry vehicle that has been delivered to the target area. Accuracy is expressed as circular error probable which is defined as the radius of a circle centered on the aim point within which 50% of the reentry vehicles are expected to be located at airburst or impact.

(U) The evaluation of accuracy is a continuing process which begins with the design of the weapon system and continues throughout the life of the flight test program. Initially, error budgets are established at the subsystem level to derive an accuracy budget at the weapon system level. The major subsystems for categorizing accuracy include guidance and control, targeting, geodetic and geophysics and reentry. Under guidance and control is included inertial measurement unit hardware errors, ground program errors, flight program errors, and certain elements in the deployment sequence. Reentry subsystem errors include the reentry vehicle and certain elements of separation. Targeting and guidance and control categorization are primarily accomplished by computer simulations.

(U) During the Small ICBM test program, flight test results will be used to validate the engineering estimates. Confidence in achieving the system accuracy goal will increase during DT&E/OT&E ground and flight testing. A mature system accuracy assessment will be completed approximately 3-5 years after Small ICBM Weapon System initial operational capability (IOC).

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64326F
DOD Mission Area: #113 - Airborne Strike

Title: Strategic Conventional Standoff Capability (SCSC)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		23,760	24,000	71,787	53,678	33,648	206,873
3025	Integrated Conventional Stores Management System	14,000	20,619	4,375	0	0	39,994
3076	Active Targeting Sensor Development	1,760	3,381	63,559	3,899	0	112,599
3160	Have Dark*	8,000	0	3,853	9,779	33,648	55,280

* FY 1985 Project 3077 Passive Targeting Sensor development has been terminated. Funding has been transferred to project 3160 Have Dark which is a special access required effort.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Strategic bombers require the capability to autonomously detect, track, classify, engage and destroy enemy mobile, fixed and maritime targets anywhere in the world while minimizing their exposure to lethal defenses. This program element provides funding for validation demonstration of Have Dark technology for present and future strategic bombers. In addition, this program element provides funding for development of an Integrated Conventional Stores Management System (ICSMS) for the B-52G. ICSMS will provide the capability to carry, launch, and jettison MIL-STD-1760 weapons for B-52Gs. Congressional addition of FY 1985 funding for active targeting sensor development will fund high resolution radar source selection leading to demonstration effort beginning in FY86.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total
RDT&E	23,760	21,619	8,228		34,226	87,833
Aircraft Procurement (PE 11113F, B-52 Squadrons)	0	0	11,675		88,534	100,209

(U) Project 3025, Integrated Conventional Stores Management System (ICSMS) procurement increase in total estimated cost is due to increasing weapon carriage on stub pylon/heavy stores adaptor beam from four to eight weapons.

(U) Project 3076, Active Targeting sensor development will proceed to demonstrate a high resolution radar (HRR) capable of target detection, classification and identification. Procurement funds for the demonstrated HRR begin in FY 1987.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
(U) PE 11113F B-52 Squadrons						
Project 3025 ICSMS						
Aircraft Procurement:						
Funds*	0	0	11,900	47,400	57,700	117,000
Quantities			(3)	(35)	(31)	(69)
Project 3076 Active Targeting Sensor Development						
Aircraft Procurement:						
Funds				118,000	331,000	449,000
Quantities					(30)	(30)

* Includes initial spares

5. (U) RELATED ACTIVITIES: Project 316_ Have Dark funding is supported by Program Element 64738F Protective Systems, project 5615 Strategic Protective Systems. The Have Dark project is a Special Access Required (SAR) effort.

6. (U) WORK PERFORMED BY: The SCSC program is managed by Air Force Systems Command's Aeronautical Systems Division Strategic Systems Program Office at Wright-Patterson Air Force Base, Ohio. Boeing Military Aircraft Company (BMAC), Wichita, Kansas, is under contract to develop the ICSMS and conduct active targeting sensor development studies. Boeing Aerospace Company, Seattle, Washington, is under contract to develop Have Dark.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3025, Integrated Conventional Stores Management System (ICSMS). Project develops an Integrated Conventional Stores Management System that implements MIL-STD-1760 on the B-52G aircraft not modified to carry air launched cruise missiles (non-ALCM). MIL-STD-1760 establishes an aircraft/weapon electrical interconnection system that defines the electrical signal set to be used between a weapon and its carrying aircraft. In addition ICSMS will restructure the Offensive Avionics System computer software to provide aircraft a generic capability of missile carriage, programming, monitor, launch and jettison for weapons designed to MIL-STD-1760. This software concept will allow the addition of new weapons without requiring recertification or flight test of the basic navigation and crew interface software.

(U) In 1984, full scale development of ICSMS was continued. Preliminary and critical engineering design reviews were completed. Hardware designs were finalized, software coding started and aircraft modification designs were completed. Decision to write a gravity weapon stores management overlay was implemented.

(U) FY 1985 activity will concentrate on completing software development, including the gravity weapon stores management overlay, testing of the software, and the fabrication of weapon control equipment for testing. A planned engineering change proposed (ECP) to increase weapon carriage from four to eight weapons per heavy stores adaptor beam was implemented. The ECP will extend the project research and development effort approximately 7 months with functional check flights to be conducted in February 1986.

(U) In FY 1986 procurement of production kits will begin. ICSMS is planned for field team installation. Research and development funding will complete eight weapon carriage ECP, fund functional check flights and correct any discrepancies.

B. (U) Project: 3160, Have Dark. Have Dark is a special access required program. FY86 effort will be funded by both Program Element 64326 and Program Element 64738F Protective Systems, project 5615 Strategic Protective Systems.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3076, Active Targeting Sensor Development

A. (U) Project Description: Active targeting sensor development would accomplish a flight demonstration of a High Resolution Radar (HRR) for strategic long range aircraft. The program would integrate and demonstrate a multi-mode sensor package employing synthetic/inverse synthetic aperture radar (SAR/ISAR), with ship classification capability moving target indication capability, moving and fixed target track capability and the ability to guide standoff weapons using radar and/or inputs from the Global Positioning System (GPS). Integration of Electronic

Surveillance Measure (ESM) technologies would also be pursued. The Flight demonstration would be conducted on a B-52 aircraft. The program pursues a three phase approach -- Phase I, FY 1985; Phase II, FY 1986 and Phase III, FY 1987 and out.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: FY 1984 activity pursues a SCSC study to develop radar specifications, define command, control, communication and intelligence requirements (C^3I), examine passive sensors, examine human factors of crew operation of such a system and finally examine electronic countermeasures required beyond installation of the ALQ-117 Pave Mint. Study definition was protracted in FY84 and actual work began in FY85. Study interim report is due in May 1985 and the final study report is due in October 1985.

(2) (U) FY 1985 Program: Phase I of the flight demonstration will be conducted in FY 1985. During this phase a demonstration radar request for proposal (RFP) will be prepared and released. Radar proposals will be evaluate and source selection accomplished. Aircraft Group A and Group B hardware design to integrate the radar into the B-52 Offensive Avionics System (OAS) will be initiated. Radar Group B hardware design will be initiated. Design of Software Integration Laboratory (SIL) and flight software will be initiated. System requirements review and Engineer g Design Review (EDR) will be accomplished during this phase.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Phase II of the flight demonstration will be conducted in FY 1986. The major portion of the total flight demonstration program will occur in this phase. This phase will cover 14 months and the Critical Design Review (CDR) will be accomplished. SIL software and hardware will be completed to support Group A/B hardware and flight software integration. Group A hardware and radar Group B design hardware will be fabricated. Flight instrumentation hardware will be designed and fabricated. Flight software intermodule compatibility testing will be completed. The flight test aircraft will arrive and preparation for modification will begin. The cost estimate used for this project are a time constrained category V (unevaluated). Initial contractor estimates have been adjusted however for normal program office additions.

(4) (U) Program to Completion: Phase III of the flight demonstration will be conducted beginning in FY 1987. This phase will cover 11 months. During this phase the modification of the airplane will be completed. Flight hardware and software integration testing in the radar integration laboratory will be completed. Installation of the radar in the test airplane and checkout will occur. Airplane electromagnetic compatibility testing will be performed. Flight testing to demonstrate the systems maritime and land capability will be accomplished.

C. (U) Major Milestones:

Milestones	Dates
(U) Phase I	
(1) (U) Radar Request For Proposal	June 1985
(2) (U) Source Selection	November 1985
(3) (U) Engineering Design Review	August 1986
(U) Phase II	
(1) (U) Critical design review	November 1986
(2) (U) Hardware design complete	December 1986
(3) (U) Hardware fabrication complete	September 1987
(U) Phase III	
(1) (U) Aircraft Modification Complete	December 1987
(2) (U) Flight Test Complete	July 1988

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64361F
DOD Mission Area: #113 - Airborne Strike

Title: Air Launched Cruise Missile, AGM-86B
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		35,902	25,039	14,179	15,096	3,807	1,200,423

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Launched Cruise Missile (ALCM) greatly enhances the air breathing leg of the Triad by: stressing and diluting Soviet defenses, thus improving the overall penetration prospects of the mixed air breathing force; compelling the Soviets to devote substantial resources to their national air defenses to counter this threat; increasing the number of weapons in our strategic forces in the near term and convincing the Soviets that their massive air defense efforts will not substantially blunt United States air breathing strike capabilities.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
PE 64361F/RDT&E	38,172	28,039	26,615		16,101	1,215,724
PE 11122F/Missile Procurement	422,237	80,478	73,495		139,360	2,956,100

(U) The reduction in FY 1986 estimated RDT&E cost ($12.4 Million) reflects the elimination of the Combined Environment Reliability Test Program due to the lack of potential increase in system reliability it could provide and delay in starting the improved engine development program.

(U) The reduction in FY 1986 estimated procurement cost ($39.1 Million) reflects a reduction in program support equipment requirements.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement (Missile Quantity)	412,273 (240)	79,376 (0)	34,440 (0)	21,868 (0)	9,502 (0)	2,752,159 (1739)
Military Construction	20,000	47,500	20,280*	42,972*	29,100*	342,652
Department of Energy Costs** (W-80 Warhead)						[ ]

* Advanced Cruise Missile not included [ ]
** W-80 cost based on [ ] warheads.

5. (U) RELATED ACTIVITIES: The AGM-86B Air Lanuched Cruise Missile (ALCM) program is managed by Air Force Systems Command's Aeronautical Systems Division located at Wright-Patterson AFB, OH. The ALCM, the land attack Sea Launched Cruise Missile (SLCM), and the Ground Launched Cruise Missile (GLCM) programs are structured to have maximum commonality in engine and navigation/guidance subsystems. The ALCM and SLCM share the common W-80 nuclear warhead developed by the Department of Energy. The engine and navigation/guidance projects are jointly managed through the Joint Cruise Missiles Project Office (JCMPO). The B-52 Squadrons, Program Element 11113F, is also related to the ALCM. The B-52 Cruise Missile Carriage, Offensive Avionics System, and other projects require close coordination with the ALCM program to ensure full compatibility.

6. (U) WORK PERFORMED BY: The major contractors are: Boeing Aerospace, Seattle, WA (air vehicle); Williams International Corporation, Walled Lake, MI and Teledyne CAE, Toledo, OH (engine); Litton Industries, Woodland Hills, CA; Litton of Canada Limited, Toronto, ONT; Minneapolis Honeywell, Minneapolis, MN (navigation guidance). In-house developing organizations are: Defense Mapping Agency and the Joint Cruise Missiles Project Office.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64361F, Air Launched Cruise Missile

A. (U) Project Description: The Air Launched Cruise Missile (ALCM) is a small, long range, accurate, nuclear armed air-to-ground cruise missile. The missile is powered by a small turbofan engine in the 600 pound thrust category. Missile navigation is accomplished by means of an inertial navigation system and a terrain contour matching

(TERCOM) system. ALCM carriage and launch will be from bomber aircraft. Initially, ALCMs will be carried on B-52G/H aircraft on external pylons and internally on launchers (B-52G external only, B-52H both external/internal). The B-1B aircraft will also be cruise missile capable for use in the 1990s and beyond.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The FY 1984 effort continued software improvements for the air vehicle, terrain correlation and mission planning system. Engine and missile radar altimeter depot development also continued. Development of an improved engine was initiated.

(2) (U) FY 1985 Program: The FY 1985 effort will continue depot development, mission planning support and development of the improved performance engine.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Development activity includes missile software improvements, mission planning improvements and completion of depot support development. Cost estimates are based on firm contractor prices for this mature production program.

(4) (U) Program to Completion: Improved engine development, complete mission planning improvements and missile software changes by FY 1988.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Defense Systems Acquisition Review Council I (Program Initiated) (AGM-86A)	February 1974
(2) (U) Defense Systems Acquisition Review Council IA (AGM-86A)	March 1975
(3) (U) First Powered Flight (AGM-86A)	March 1976
(4) (U) Defense Systems Acquisition Review Council II (AGM-86A/B)	January 1977
(5) (U) AGM-86B/AGM-109 Competition Directed	July 1977
(5) (U) First Full Scale Engineering Flight	July 1979
(7) (U) Source Selection	March 1980
(8) (U) Defense Systems Acquisition Review Council III (Production Decision)	April 1980
(9) (U) First Alert Capability (One B-52G)	September 1981
(10) (U) Initial Operational Capability (First B-52G Squadron)	December 1982
(11) (U) Full Operational Capability (AGM-86B)	Fiscal Year 1987

Budget Activity: 3, Strategic Programs
Program Element: 64361F/11122F, Air Launched Cruise Missile

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): In 1975 and 1976, six advanced development tests were conducted on the short range Boeing AGM-86A Air Launched Cruise Missile (ALCM). Four of the six flight tests were successful.

(U) The Full Scale Development (FSD) program for the long range ALCM was structured into two phases. The first phase was the competitive flyoff between the Boeing AGM-86B and the General Dynamics AGM-109. The ten flights per competitor were further divided into three DT&E flights conducted by contractors and seven DT&E/Initial Operational Test and Evaluation (DT&E/IOT&E) flights conducted by a joint Air Force DT&E/IOT&E test team. The Boeing AGM-86B was chosen to enter production in April 1980. The second phase consisted of 20 follow-on flights to support B-52G Integrated Weapon System (IWS) testing.

(U) The majority of the reliability and maintainability testing was conducted during the follow-on test program when sufficient production configured support equipment was available. During the flyoff the contractors were expected to demonstrate a test reliability of .575 to .744 for a hypothetical mission of 12 hours captive carry and 5 hours of free flight. The AGM-86B achieved a value of .68.

(U) Other contractors in the ALCM program are Williams International, Walled Lake, MI for the engine, with Teledyne CAE, Toledo, OH, the second source. Inertial Navigation Elements are provided by Litton, Woodland Hills, CA and Litton of Canada, Toronto, Canada. Missile Radar Altimeters are provided by Honeywell, Minneapolis, MN. Boeing Military Aircraft Company, Wichita, KS is the cruise missile integration contractor responsible for B-52G modification and integration. The production decision which approved full rate ALCM production occurred in April 1980.

(U) Development Test Reports published: AGM-86 Air Launched Cruise Missile (ALCM) Development Test and Evaluation Competitive Test Program, Vol I thru VI, May 1980 and AGM-109 Air Launched Cruise Missile (ALCM) DT&E Competitive Test Program, Vol I thru VI, May 1980.

2. (U) Operational Test and Evaluation (OT&E): The Air Force Operational Test and Evaluation Center (AFOTEC) was responsible for IOT&E and the early phase of Follow-on Operational Test and Evaluation (FOT&E) of the ALCM. The ALCM test team was located at Edwards AFB, California, and comprised of personnel from AFOTEC, Strategic Air Command (SAC), Air Force Logistics Command and Air Training Command. The IWS program combines ALCM and Offensive Avionics System (OAS) testing.

Budget Activity: 3, Strategic Programs
Program Element: 64361F/11122F, Air Launched Cruise Missile

(U) The Defense Systems Acquistion Review Council (DSARC) III, which met on 17 April 1980, provided direction for production, FOT&E, continuation of reliability and maintainability efforts, and management attention on improving Boeing Aerospace Company quality assurance for this program.

(U) Air Launched Cruise Missile (ALCM) Follow-on Operational Test and Evaluation (FOT&E) testing from April 1980 through May 1981 consisted of 11 ALCM launches from a non-Offensive Avionics System (OAS) B-52G used during the competition. All subsequent launches were from B-52Gs equipped with OAS. A total of 20 launches were conducted during the period between the flyoff and Initial Operational Capability (IOC) in December 1982. Fourteen successes, 3 partial successes and 3 failures resulted. Overall, AFOTEC rated the IWS as potentially capable of fulfilling Strategic Air Command's (SAC) requirements.

(U) SAC-conducted ALCM FOT&E Phase II began July 1983 and will continue throughout the system's operational life cycle. Approximately twelve ALCM launches are scheduled each fiscal year from operational SAC bomb wings under the nickname "GLOBAL CRUISE". This testing is managed by HQ SAC and conducted by the 4201st Test Squadron. The ALCM FOT&E program is designed to test the complete weapon system in the most operationally realistic environment possible. Present limitations to testing are airspace constraints, weather criteria and terrain diversity; missions over the Canadian route planned for 1985 and future years will significantly increase the realism in all three areas. SAC's ALCM testing is also included in the framework of the B-52 IWS FOT&E that evaluates the B-52 OAS, ALCM, Short Range Attack Missile (SRAM) and delivery of nuclear gravity weapons as an integrated weapon system. Specific test objectives are designed to:

a. Provide inputs to HQ SAC planners in determining weapon system accuracy and reliability.

b. Verify current employment concepts, tactics and techniques, and identify operational deficiencies.

c. Verify adequacy of technical data and equipment currently used in maintenance, check-out and operation of the weapon system.

d. Evaluate the performance of the weapon system to include aircrew, software and hardware.

e. Continue evaluation of those areas recommended as a result of previous testing.

(U) To date, operational performance demonstrated by FOT&E has met the advertised specifications in suitability, reliability, and maintainability. Important results achieved from recent testing include the validation of revised software for the ALCM and the captive carry of an ALCM over the Canadian Test Route.

Budget Activity: 3, Strategic Programs
Program Element: 64361F/11122F, Air Launched Cruise Missile

(U) Test Reports Published:

(1) ALCM OT&E Final Report, HQ AFTEC, September 1981.
(2) ALCM Survivability Follow-on Operational Test and Evaluation Final Report, HQ AFTEC, May 1982.
(3) B-52 Integrated Weapon System (IWS) Operational Test and Evaluation Follow-on Operational Test and Evaluation Final Report, HQ AFOTEC, September 1983.
(4) Global Cruise B-52 Integrated Weapon System Follow-on Operational Test & Evaluation (U) Test Report 1 July - 31 October 1983, HQ SAC, 1 March 1984.

3. System Characteristics:

Physical Characteristics	AGM-86B (ALCM)
Length (feet)	20.75
Diameter (inches)	27.30
Weight (pounds)	3144
Wing Span (feet)	12
Wing Area (square feet)	11
Warhead Yield (kilotons)	
B-52 Internal Carriage (each)	8
B-52 External Carriage (each)	12

Performance Data	Specification	Demonstrated
Maxium Low Altitude Speed (Mach number)		
Minimum Launch Altitude (feet)		
Minimum Enroute Altitude (feet)		
Propulsion Range (kilometers) 1/		
System Operational Range (kilometers)	2500	2500
Accuracy (Circular Error Probable-feet) 2/		

1/ Low altitude at

2/ At last fix within nautical miles of target, terminal cell size

Budget Activity: 3, Strategic Programs
Program Element: 64361F/11122F, Air Launched Cruise Missile

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
ALCM Launch	One launch per month.	18 January 84	Success- First flex-target mission
ALCM Launch		20 January 84	Success- DOE payload
ALCM Launch		23 February 84	Success
Captive carry		6 March 84	Canadian captive
ALCM Launch		20 March 84	Success
ALCM Launch		9 April 84	Success
ALCM Launch		8 May 84	Success
ALCM Launch		10 May 84	Success
ALCM Launch		14 June 84	Failure- Missile generator/ regulator.
ALCM Launch		10 October 84	Success
ALCM Launch		16 October 84	Success

T&E Activity (Next 12 Months)
One ALCM launch per month planned

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64406F
DOD Mission Area: #123 - Space Defense

Title: Space Defense Systems
Budget Activity: #3 Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		202,668	132,959	149,934	80,357	Continuing	N/A
2134	Miniature Systems*	178,274	125,796	149,934	80,357	Continuing	N/A
2135	Advanced Systems	470	537				
2241	Instrumented Test Vehicle	23,924	6,626				

* Activities previously funded in Project 2135, Advanced Systems, and Project 2241, Instrumented Test Vehicle, will be funded in Project 2134, Miniature Systems, in FY 1986 and beyond.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is developing and testing an antisatellite (ASAT) system in response to guidance contained in National Space Policy and the Secretary of Defense approved Mission Element Need Statement. The system is designed to deter Soviet ASAT attacks on U.S. space systems and to remove the sanctuary status the Soviets currently enjoy in space by providing a capability to deny them the use of those space assets which enhance the effectiveness of their land, sea and aerospace forces. The air-launched miniature vehicle (ALMV) ASAT currently under development consists of a modified Short Range Attack Missile (SRAM) first stage, an Altair second stage, and a Miniature Vehicle (MV) warhead. ASAT missiles will be launched from designated, dual mission, air defense F-15s. To support ASAT testing, a dedicated target satellite (Instrumented Test Vehicle) is being developed. Enhancements to the ALMV ASAT, which will allow it to be responsive to the evolving threat, are funded in this project.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	203,568	143,278	101,731		Continuing	N/A
Missile Procurement	19,309	82,997	128,931		Continuing	N/A
Aircraft Procurement	0	18,100	24,100		Continuing	N/A

FY 1985 RDT&E - $10,278 thousand deleted by Congress. No rationale given.
FY 1986 RDT&E - $48,203 thousand added in FY 1986 for test program stretch out and engineering fixes of deficiencies identified during test program, and to continue pre-planned product improvements.

FY 1985 Missile Procurement - $9,000 thousand deleted by Congress for missile advance procurement. No rationale given.
FY 1986 Missile Procurement - Air Force reduced funding in FY 86 to rephase total missile procurement.
FY 1985 Aircraft Procurement - $9,000 thousand deleted by Congress for carrier aircraft equipment. No rationale given.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Weapon Pylons and Pallets (PE 12450F)						
Funds	0	8,600	34,500	58,100	Continuing	N/A
Quantities	0	1	4	8	Continuing	N/A
Missile Procurement:						
Antisatellite (ASAT) Missile (PE 12450F)						
Funds	19,300	74,000	97,916	148,895	Continuing	N/A
Quantities	Adv Buy	2	3*	[ ]	Continuing	N/A
Military Construction:						
Operational Facilities (PE 12450F)						
Funds			14,900		22,073	36,973

*The P-1 document shows that three ASAT missiles will be procured in FY 86. However, current estimates indicate we can obtain only two missiles.

5. (U) RELATED ACTIVITIES: This program is part of the Air Force Space Defense Systems Program effort involving four functional areas: Antisatellite, Space Surveillance Technology, Satellite Systems Survivability, and Command and Control. Program Element 12311F, North American Aerospace Defense Cheyenne Mountain Complex - Space Defense Systems is developing the command and control segment of the ASAT system in two steps. The test support and initial operational capability is provided by the Prototype Mission Operations Center. It will be replaced by the Mission Control Center for full operational capability. Program Element 63438F, Satellite Systems Survivability, is developing generic technology to enhance the survivability of United States space systems. Program Element 12424F, SPACETRACK, provides the necessary tracking capability.

6. (U) WORK PERFORMED BY: Air Force Systems Command's Space Division, Los Angeles AFS, CA manages this program. The Aerospace Corporation, El Segundo, CA provides technical support. Air-launched ASAT contractors are: Vought Corporation, Grand Prairie, TX; Boeing Aerospace Company, Seattle, WA; AVCO, Wilmington, MA; and Logicon Corporation, Los Angeles, CA. Vought Corporation is developing the ASAT missile upper stage. Boeing Aerospace Company is developing the

missile lower stage and the carrier aircraft equipment (pallet and pylon); AVCO is developing the instrumented test vehicle (ITV); and Logicon is performing all software verification and validation. The Arnold Engineering Development Center and Air Force Systems Command Space and Missile Test Organization are both supporting the antisatellite (ASAT) development and test efforts.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2134, Miniature Systems

A. Project Description: This project funds the development and test of the Air-Launched Miniature Vehicle (ALMV) ASAT, the Instrumented Test Vehicle, and enhancements to the ALMV. The ALMV ASAT weapon system has two elements, the ASAT missile and the carrier aircraft equipment (CAE). The first stage of the ASAT missile is a modified Short Range Attack Missile (SRAM). The second stage uses an Altair motor for propulsion. The second stage contains the reaction control system (RCS) for attitude control, the missile guidance assembly (MGA), a cryogenic system, and the miniature vehicle (MV) dispenser. The MV, carried in the second stage, is the terminal warhead of the missile. The CAE, installed in modified F-15 aircraft, is used to carry and launch the missile, and to provide the interface between the ASAT missile and the F-15 weapon control system. The ALMV weapon system will satisfy the 10 April 1981 Mission Element Need Statement (MENS) for a low altitude antisatellite capability. Instrumented Test Vehicles (ITVs) are required as orbital test targets to evaluate the effectiveness of the ALMV ASAT system. The target is required to evaluate the probability of kill. Miniature vehicle specifications call for a probability of kill (single shot) of The ITV is a six-and-one-half foot diameter balloon-like satellite with a controllable Long Wavelength Infra-red (LWIR) signature system (for simulating different Soviet targets) and miss distance and impact instrumentation. For each of five launches, two ITVs will be launched via a single SCOUT booster from the NASA Wallops Flight Facility. The ITVs will be controlled by the Air Force Satellite Control Facility, Sunnyvale, CA.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Twelve captive-carry flight tests of the ASAT missile were completed. The point-in-space flight, the first live launch, occurred on 21 January. This test successfully demonstrated the proper functioning of the first and second stage propulsion systems and the missile guidance system. The secondary objectives of this test, to demonstrate the planned upper stage pointing functions, spin-up and deployment of the MV simulator, and tracking of the telemetry and beacon aboard the MV simulator, were also accomplished. Absolute calibration of the Flight Sensor Assembly (FSA) of the MV, using a black body source, began at Arnold Engineering Development Center in January and will be completed in the first quarter of FY 1985. This testing has demonstrated that a two-laser method of calibration will measure performance adequately and that the sensitivity of the FSA is better than predicted. Qualification testing of the MV continued. Fabrication was completed for the first two ITVs which will be used in the intercept phase of the ASAT test program. Acceptance tests for these Instrumented Test Vehicles (ITVs) were completed.

An additional communications link test between the launch site and the Air Force Satellite Control Facil: was conducted successfully in May using the instrumented test vehicle (ITV) qualification vehicle. Project 21 Advanced Systems, funded system concept definitions for a space-based laser. Management responsibilities for these efforts have been transferred to the Strategic Defense Initiative Office in FY 1985.

(2) FY 1985 Program: Antisatellite (ASAT) missile captive-carry flights will continue in support of the live fire tests. The infrared probe test was completed on 13 November 1984. The objective of the test was to reaffirm the performance of the missile as demonstrated during the point-in-space test and, in addition, to demonstrate the capability of a miniature vehicle (MV) to acquire and track an infrared-emitting body in a deep space background, in this case, a star. The test was a partial success. While not all test objectives were achieved, it appears that sufficient data were gathered to allow the test program to proceed to the next phase, the intercept tests. Engineering changes will be made to the ASAT missile system as required by test results. The first two ITV satellites will be shipped to the Wallops Island Flight Facility, mated to a SCOUT booster, and launched in support of ASAT tests in second SCOUT launch is planned in support of the third and fourth intercept tests The program office will begin initial analysis to determine the requirements for a new ASAT missile motor.

An Independent Cost Analysis is being performed by HQ USAF to support the FY 1985 production decision.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: ASAT flight testing will continue. Two SCOUT launches are planned which will place four ITVs into orbits representative of various Soviet low-altitude threat satellites. ASAT flights against ITVs will exercise more demanding portions of the test envelope. Mission profiles against the four ITVs will more closely emulate operational conditions. Mission control procedures will be refined as necessary. Engineering changes to the ASAT missile system will be incorporated as necessary. The final four ITVs will be fabricated and delivered. They will be launched on two SCOUT boosters in support of intercept tests. AVCO will support launch operations and perform post flight data reduction. Operations, maintenance, deployment and base activation planning for the operational ASAT will continue. Construction of ASAT facilities at Langley AFB will begin. Cost estimates are based upon existing contracts cost data; design-to-cost goals (Feb 1983); and life-cycle cost data (updated by Program Office semiannually).

(4) Program to Completion: This is a continuing program. System performance upgrades developed as a result of flight test will be incorporated into production missiles. ASAT facilities at Langley AFB, VA will be activated to support the Initial Operational Capability (IOC). McChord AFB, WA will become the second operational ASAT base As the threat changes, new development efforts should be anticipated. The program office will conduct analyses of how to respond to various types of satellite maneuvers or other countermeasures the Soviets might attempt.

C. Major Milestones:

		Milestones		Dates
(1)	(U)	Instrumented Test Vehicle (ITV) Contract Award		May 1979
(2)	(U)	Start Fabrication of Flight-Test Missiles		October 1981
(3)	(U)	First Modified F-15 Available for Test		July 1982
(4)	(U)	First Missile Captive Flight Test		December 1982
(5)	(U)	Miniature Vehicle Ground Tests Complete		January 1983
(6)	(U)	ITV Performance Tests Complete		May 1983
(7)	(U)	ITV Qualification Tests Complete		June 1983
(8)	(U)	Missile Qualification Test Complete		October 1983
(9)	(U)	Point-in-Space Flight Test		January 1984
(10)	(U)	Infrared Probe Test		November 1984
(11)		Miniature Vehicle (MV) Qualification Test Complete		
(12)	(U)	First Instrumented Test Vehicles (ITV) On-Orbit	*(July 1984)	June 1985
(13)		Intercept Flight		
(14)		Initial Operational Capability		

* Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(12) (U) Instrumented Test Vehicle launch delayed because of technical difficulties experienced during miniature vehicle qualification testing and Congressional restrictions.

(14)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): During FY 84, antisatellite (ASAT) testing transitioned from mechanical fit checks and ground integration testing to aggressive captive and free flight testing. The main goal of this part of the program has been to corroborate analyses and ground test results through flight test in preparation for the first intercept. Flight testing is being conducted by the contractors, Air Force Western Test Range, Air Force Operational Test and Evaluation Center (AFOTEC), the Air Force Flight Test Center (AFFTC), the Air Force Satellite Control Facility (AFSCF), and Space Command.

(U) The lower stage (L/S) is a standard Short Range Attack Missile (SRAM) with modified control fins and electronics. A total of six lower stages have been identified from existing SRAM inventories to date; one for captive flight testing, one for qualification testing and four for live launches. All pre-launch testing of lower stages has been completed. Free flight data analysis from the first ASAT launch supports ground test predictions of L/S performance.

(U) The upper stage (U/S) of the ASAT missile has completed qualification testing at both component and system levels. Major components include a Scout Altair Star 20B solid rocket motor, a modified F-16 inertial guidance platform, a reaction control system and a cryogenic cooling system. The U/S also has instrumentation and flight termination systems used to support the flight test program requirements. The past year has included efforts to improve the reliability of the flight termination system and improve the understanding of the real vibro-acoustic environment for captive flight. These efforts are nearing completion and modifications to hardware are being evaluated. All deliverable hardware is anticipated to be in stores by late CY 1985. Studies are in progress to identify design fixes to eliminate current operational limitations and provide verification by the completion of the flight test program. First launch showed excellent performance of the U/S hardware and software to deliver a payload emulator to a predetermined point in space.

(U) Missile level qualification testing was completed in Sep 83. Additionally, a modal survey was conducted on the assembled missile and the carrier aircraft equipment (CAE), and final ultimate load structural tests on the structural test missile were finished in Nov 82. Free flight test results from the first launch fully supported the ground test predictions of system performance.

(U) Component level testing of the miniature vehicle (MV) flight sensor assembly (FSA) was conducted in early FY 81. This FSA performance demonstration showed that the sensor should meet performance requirements and that the two laser test method should adequately measure sensor performance. Testing of early production models of the sensor processing electronics (SPE) revealed excessive noise leading to electronics modifications. Another anomaly observed was the dielectric relaxation effect (DRE) being different than predicted. Mission simulations of the results of this effect indicate that system accuracy can be preserved by selection of the proper detector operating conditions. Validation of the laser test method and characterization of the sensor's response to a "blackbody" source has been

underway at the Arnold Engineering Development Center (AEDC) since Jan 84. Preliminary results are positive with a small responsivity bias being the only significant difference from the laser test results noted thus far. Formal miniature vehicle (MV) qualification testing has been ongoing since Dec 83. Six of the eight parts of the testing (up to self-induced shock testing) had been successfully completed by Oct 84. In early Nov 84, during the self-induced shock testing, one of the maneuver motors on the miniature vehicle burst. The cause of this failure is still under investigation. The first free flight test of an MV occurred on 13 Nov 84 during the infrared probe (IRP) shot.

(U) The antisatellie (ASAT) Prototype Mission Operation Center (PMOC) calculates mission parameters used to guide and control an ASAT intercept against a selected target. The PMOC is a part of Program Element 12311F, North American Aerospace Defense Command (NORAD) Cheyenne Mountain Complex (NCMC) - Space Defense Systems. The PMOC is located at the NCMC and is comprised of an IBM 4341 computer with relevant mission planning and communications software, communication links to Vandenberg and Edwards Air Force Bases, interfaces with the NORAD Communication System Segment (CSS) and NORAD Space Surveillance Center (NSSC). There are two sets of IBM hardware, the primary set is located at the NCMC and a certified backup is located at the Program Generation Center (PGC) in Seattle. The PMOC software developed by Boeing and Vought is now being utilized at the PMOC to provide the mission data loads for the ASAT captive and free flight tests at Edwards AFB. PMOC support of captive and free flight testing has been outstanding and is presently part of the ASAT/Mission Control Segment (MCS)/instrumented test vehicle (ITV) integration testing efforts.

(U) The ASAT flight test program is designed to be a combined Development Test and Evaluation and an Initial Operational Test and Evaluation (DT&E/IOT&E) program. It is comprised of an interlaced series of captive carry flight tests and live-fire (free) flight tests. Captive carry tests began in mid-Dec 82 with a total of 125 hours of flight tests planned. Twelve live-fire launches are planned.

(U) A captive flight test missile (CFTM) has been fabricated for the captive carry flight program. This missile is functionally equivalent to the flight test missile (FTM). In the CFTM, the MV is replaced by an emulator which has the same mass properties and electrical interfaces as an actual MV. CFTM pyrotechnics and propulsion are inert. The CFTM is presently in captive flight testing. Tests and procedures developed for the CFTM are directly applied to assembly and checkout of the 15 FTMs procured for the program.

(U) The captive carry flight program objectives are the assessment of F-15 performance with the ASAT missile mated, evaluation of the navigation function of the missile, evaluation of the pilot/ASAT system interaction, and assurance of test range readiness for live-fire launches. The captive carry program has successfully demonstrated adequate F-15/ASAT launch performance, range metric and telemetry coverage, range safety command and control, and system navigation functions. Pilot/ASAT interaction tests have identified areas for improvement in waypoint steering capabilities and supersonic launch performance. These remaining areas are being worked to support the first instrumented test vehicle (ITV) intercept and first supersonic launch requirement.

Extensive planning is in progress for twelve live-fire missile tests. The first live-fire flight test, with the basic upper and lower stages of the missile [redacted] was completed successfully on 21 January 1984. The objective of this test was to evaluate the capability of the system to deliver a miniature vehicle (MV) to a specific point in space (PINS) at a designated time. This test was also used to verify the

capabilities of the Western Test Range (WTR) at Vandenberg AFB to support data acquisition during subsequent tests.

The second antisatellite (ASAT) flight, an infrared probe (IRP) test, was launched on 13 Nov 84. The primary objective of the test was to demonstrate the capability of the miniature vehicle (MV) to acquire and track a fixed infrared-emitting object, in this instance, a star. The test was also designed to reaffirm the performance of the first and second stage propulsion systems, the missile guidance system, upper stage pointing functions, and spin-up and deployment of the MV. The missile performed as planned and delivered the upper stage to a predetermined point in space.

The ten remaining flights in the flight test program will be flown using the instrumented test vehicle (ITV) and/or resident space objects (RSOs) as targets. Eight of these flights have primary objectives which test performance of the missile and MV. Two flight tests have primary objectives which stress operational rather than engineering issues. Data from all twelve flights will provide information to resolve both engineering and operational concerns defined by the combined DT&E/IOT&E program.

2. (U) Operational Test and Evaluation (OT&E): The AFOTEC initial operational test and evaluation (IOT&E) of the ASAT system began with the combined development test and evaluation (DT&E)/IOT&E flight tests in late CY 83. DT&E and IOT&E objectives will be addressed in the planned intercept of eight ITV satellites and two resident space objects (RSOs). The threat representative RSO target satellites have not been identified. DT&E objectives will be primary on the initial flights, and IOT&E objectives will be primary on the later flights.

(U) The DT&E/IOT&E, conducted by the 6510th Test Wing and AFOTEC at Edwards AFB, California, will address the weapon segment (missile, F-15, and associated support equipment). The IOT&E objectives for the surveillance, command, and control segments (Prototype Mission Operations Center with associated space track sensors inputing targeting data) are being addressed by AFOTEC and Space Command personnel at the NORAD Cheyenne Mountain Complex. The contractor will operate and maintain the system during the test program.

(U) The first two production runs of missiles will be the same configuration as the test articles. Future productions will have improvements incorporated that will have to be tested. Award of the first limited productions contract is planned for mid-CY 85. The DT&E/IOT&E will not be complete until early CY 87. This is the approved schedule.

(U) Twenty-seven captive-carry flight tests, a flight test to a point in space, and an infrared probe test have been performed to date. Evaluation of the system's performance began with the first flight test. The IOT&E test report will be published in early CY 85 to support a limited production decision.

Budget Activity: 3, Strategic Programs
Program Element: 64406F, Space Defense Systems

3. (U) System Characteristics:

(U) System Performance and Supportability:

Characteristic	Objective/Threshold	Demonstrated	Method
- Probability of Kill (single shot)		-	DT&E/IOT&E Flight Test
- Effectiveness[1]		-	DT&E/IOT&E Flight Test
- Altitude Capability			
-- High[2]		-	DT&E/IOT&E Flight Test
-- Low[3]		-	DT&E/IOT&E Flight Test
- Mean Time Between Maintenance Actions	6* months/TBD	-	IOT&E/FOT&E Test
- Mean Time to Repair (Organization Level)	4* hours/TBD	-	IOT&E/FOT&E Test
- Mean Time to Repair (Intermediate Level)	12* hours/TBD	-	IOT&E/FOT&E Test
- Fault Isolate	0.5* hours/TBD	-	IOT&E/FOT&E Test
- Ready Alert[4]	14* days/TBD	-	IOT&E/FOT&E Test
- Preflight	2.6 hours*; 1.5hours†/TBD	-	IOT&E/FOT&E Test

* Goal at Full Operational Capability (FOC)
† Goal at Limited Capability (LC)
1 Effectiveness is the expected probability of negation of each of the priority 1 and 2 targets within 24 hours.
2 The high altitude capability shown is the mean value minus 3 sigma at a missile range of 100 nautical miles.
3 The low altitude capability will be determined by analysis if no suitable resident space objects can be identified.
4 Ready alert is the period the antisatellite (ASAT) system can stand ready to negate required targets.

(U) Subsystem Characteristics: Prototype Flight Test Missile (PFTM)

(U) First Stage: Standard Short Range Attack Missile plus ASAT modifications including two fixed fins, three modified variable fins, and flight control electronics.

(U) Characteristic		Objective/Threshold	Demonstrated	Method
- Weight (total)	(Pounds)	1723/1750	1714	DT&E Measurement
- Thrust	(Pounds)	7511/TBD	7511	DT&E Ground Test
- Temperature	(Degrees Fahrenheit)	65 to +145°/TBD	-65 to +145°	DT&E Environmental Test
- Total Impulse	(Pound-Seconds)	255,000/TBD	255,000	DT&E Ground Test

Budget Activity: 3, Strategic Programs
Program Element: 64406F, Space Defense Systems

(U) Second Stage: Standard ALTAIR III with minor structural modifications, reaction control system, and missile guidance assembly. Weight is as attached to lower stage prior to flight and includes miniature vehicle dispenser.

(U) Characteristic		Objective/Threshold	Demonstrated	Method
- Weight (total)	(Pounds)	983/1013	1003	DT&E Measurement
- Thrust	(Pounds)	5650/To Be Determined (TBD)	5650	DT&E Ground Test
- Temperature	(Degrees Fahrenheit)	-40 to +100°/TBD	-40 to +100°	DT&E Ground Test
- Total Impulse	(Pound-Seconds)	173,000/TBD	173,000	DT&E Ground Test
Miniature Vehicle:				
- Sensor	(Long Wavelength Infrared)			
- Weight	(Pounds)	TBD		DT&E Measurement
- Dimensions	(Inches)	TBD		DT&E Measurement
- Destruct Mechanism		Hypervelocity Impact	-	DT&E Flight Test

4. Current Test and Evaluation (T&E):

Event	T&E Activity (Past 12 Months) Planned Activity	Actual Date	Remarks
DT&E/IOT&E live fire to a point-in-space.	1st Qtr FY 84	2nd Qtr FY 84	Delayed about three months because of minor mechanical, electrical, and software problems.
DT&E/IOT&E live fire test of miniature vehicle (MV) performance using infrared-emitting star as source.	2nd Qtr FY 84	1st Qtr FY 85	Late delivery of test articles and longer-than-anticipated assembly and check-out

Event	T&E Activity (Next 12 Months) Planned Date	Remarks
First DT&E/IOT&E instrumented test vehicle (ITV) intercept	[ ]	Based on completion of MV qualification testing.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64711F
DOD Mission Area: #113 - Airborne Strike

Title: Systems Survivability (Nuclear Effects)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		11,703	9,055	7,927	11,121	Continuing	N/A
2485	S/V Assessment of C^3 Systems	1,882	2,100	1,520	2,690	Continuing	N/A
3763	S/V Assessment of Aerospace Systems	6,260	6,955	6,407	8,431	Continuing	N/A
4695	S/V Assessment of Satellites	3,561	0	0	0	0	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Develops and demonstrates the advanced technology and engineering capability required to assess, harden and maintain Air Force and DOD aerospace (aircraft and missiles) and command, control and communications (C^3) systems which must operate and survive in a nuclear environment. Determines through analysis and testing, the survivability/vulnerability (S/V) of Air Force and DOD aerospace and C^3 systems, and associated structures to nuclear effects.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	11,703	9,057	10,587		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This Program is related to Air Force programs to develop and maintain a survivable strategic force with associated C^3 systems. Related programs are: Program Element 64747F/Project 1209, Nuclear Effects Simulation Test Facilities; Program Element 62601F/Project 8809, Nuclear S/V Technology; and Program Element 63244F, Aircraft Nonnuclear Survivability. Test facilities for this program are acquired under Program Element 64747F/Project 1209. A joint working group between the Air Force, the Defense Communications Agency, and the Defense Nuclear Agency has been established to coordinate C^3 assessment plans and to effect timely exchange of results. The Under Secretary of Defense for Research and Engineering has established a Military Standards and Specifications for Electromagnetic Pulse (EMP) Program to develop EMP standards and specifications in accordance with the Defense Standards and Specifications Program.

6. (U) WORK PERFORMED BY: The program is managed by the Air Force Weapons Laboratory, Kirtland AFB, NM. Contractual work is performed by Mission Research Corporation, Santa Barbara, CA (Project 2485); Dikewood Corporation, Albuquerque NM (Project 3763); TRW Incorporated, Albuquerque, NM (Project 3763); R&D Associates, Marina Del Rey, CA (Project 2485).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2485, Survivability/Vulnerability (S/V) Assessment of Command, Control and Communications Systems. This project develops, acquires and uses assessment techniques and electromagnetic pulse (EMP) test data to determine the nuclear S/V of critical ground command, control and communications (C^3) systems, and develops and evaluates techniques for hardening these systems. During FY 1984 technical assistance was provided on Strategic Air Command and United States Air Forces Europe (USAFE) command post EMP hardening efforts; tests were initiated to validate a phased array, low frequency, survivable C^3 concept; testing of a ground based EMP detection system was completed; and fiber optics hardening technology development was completed. In FY 1985 an EMP data base for C^3 systems, aircraft and missiles will be developed; technical support will be provided for the ground launched cruise missile C^3 system EMP test; a test of the EMP shielding of the USAFE Operations Support Center will be conducted, and development of survivable alternative C^3 concepts will continue. In FY 1985 assessment of existing C^3 facilities and alternative survivable C^3 systems will continue; and development of hardness assurance, maintenance and surveillance (HAMS) technology for C^3 facilities will begin.

B. (U) Project: 3763, Survivability/Vulnerability Assessment of Aerospace Systems. This project determines, through analysis and testing, the nuclear S/V of aerospace systems (aircraft and missiles) and associated structures, and develops and evaluates techniques for hardening and maintaining the hardness of these systems. During FY 1984 the EMP test aircraft (EMPTAC) was acquired; definition of EMPTAC experiments was completed; a major effort was initiated to develop advanced EMP hardening techniques; experiments were conducted to compare the effects of EMP and lightning on aircraft; development of EMP standards and specifications continued; development of a mobile EMP direct drive simulator was completed; and the testing and analysis of the response of strategic structures to blast and shock continued. In FY 1985 experiments will be conducted on EMPTAC to develop improved EMP testing techniques and to demonstrate EMP hardening techniques; development of advanced EMP hardening techniques will continue; development of interim black box level EMP standards and specifications will be completed; development of the HAMS technology required to support life cycle nuclear hardness maintenance will be initiated; and testing and analysis of the response of strategic structures to blast and shock will be continued. In FY 1986 the EMPTAC and advanced EMP hardening technology programs will continue; development of subsystem and system level EMP standards and specifications for aircraft will begin; development of HAMS technology will continue and include testing on EMPTAC; development of improved EMP testing techniques will continue; and the testing and analysis of the response of strategic structures, including missile silos, to blast and shock will continue.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11113F
DOD Mission Area: #113 - Airborne Strike

Title: B-52 Squadrons
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	68,723	22,167	16,047	9,982	0	539,000*
2406	B-52 Offensive Avionics System	2,600	0	0	0	0	231,561
2601	Strategic Radar Update	39,223	4,900	0	0	0	142,217
2632	Offensive Avionics System Cruise Missile Integration Weapon System Trainer Modification	5,500	0	0	0	0	22,600
2692	Autopilot Upgrade	13,000	5,700	5,000	0	0	23,700
2787	Conventional Standoff Capability/Harpoon	6,300	0	0	0	0	7,938
2824	Mission Data Preparation System	2,100	6,000	0	0	0	15,670
3031	Avionics Software Development	0	5,567	7,647	9,982	0	23,196
3156	Offensive Avionics System (OAS) Hardening	0	0	3,400	0	0	3,400

* Total includes funds for projects completed in prior fiscal years

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program maintains the effectiveness of the B-52 force by adding new systems which improve the aircrafts' capabilities and by modifying existing systems to improve reliability and maintainability. These modifications are consistent with the intended future roles and missions of the aircraft.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Research, Development, Test and Evaluation (RDT&E)	76,098	22,167	8,072		Continuing	N/A
Aircraft Procurement*	383,000	358,000	309,500		566,500	3,366,400

* Funds reflected are those associated with RDT&E tasks shown above and include initial spares

A. RDT&E Differences: Two projects were added to the B-52 program. Offensive Avionics System (OAS) Hardening, project 3156, Due to late contract award for the autopilot in FY 1984, funds were reprogrammed for higher priority efforts. Funds are restored in FY 1986 to complete the project.

B. (U) Procurement Differences: Beginning with the FY 1986 Congressional Descriptive Summary, only those projects requiring RDT&E resources in FY 1986 - FY 1990 are shown.

(1) (U) FY 1984: FY 1985 Descriptive Summary included funds for Cruise Missile Integration, Offensive Avionic System, Fuel Quantity Indicating System, Environmental Control System, Strategic Radar Update, and Harpoon Integration. Funds for those projects, with the exception of Strategic Radar, are not shown in FY 1986 because they do not require FY 1985/1986 RDT&E resources.

(2) (U) FY 1985: FY 1985 Descriptive Summary included funds for Cruise Missile Integration, Autopilot, Fuel Quantity Indicating System, Environmental Control System, and Strategic Radar Update. Only Autopilot and Strategic Radar Update require FY 1985/1986 RDT&E funds and, therefore, are the only B-52 programs listed in paragraph 4.

(3) (U) FY 1986: FY 1985 Descriptive Summary included funds for Cruise Missile Integration, Autopilot, Environmental Control System and Strategic Radar Update. Only Strategic Radar Update and Autopilot, with RDT&E in FY 1985, are shown.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement*	103,900	139,200	122,900	108,300	89,500	563,800

* Funds reflected are for only those RDT&E projects with procurement in FY 1986 and out and include initial spares.

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Project 2601, Strat Radar Upgrade						
Aircraft Procurement	103,900	139,200	97,300	75,000	83,200	498,600
(Quantity)	(11)	(62)	(63)	(62)	(65)	(263)
Project 2692, Autopilot Upgrade						
Aircraft Procurement			25,600	33,300	6,300	65,200
(Quantity)			(65)	(160)	(38)	(263)

5. (U) RELATED ACTIVITIES: Program Element 64234F, Common Strategic Rotary Launcher (CSRL), develops a multipurpose launcher for the B-52H. CSRL is a Class V Modification to the B-52 and the launchers are procured under PE 11113F. Program Element 64325F, Strategic Conventional Standoff Capability (SCSC) provides for development of improved conventional targeting sensors and full-scale development of an Integrated Conventional Stores Management System (ICSMS)/ B-52 MIL-STD-1760. The targeting sensor improvements will have applicability to all strategic aircraft. ICSMS will provide the capability to launch, carry and jettison MIL-STD-1760 weapons on the B-52G. Procurement of both the sensors and ICSMS will be funded under the respective aircraft program elements.

6. (U) WORK PERFORMED BY: Boeing Military Airplane Company, Wichita, Kansas, will perform the RDT&E efforts planned in FY 1986. Both projects deal with the Offensive Avionics System of the B-52. As such, existing contracts will be modified to include the FY 1986 work. Both projects will be managed by the Aeronautical Systems Division of Air Force Systems Command, Wright-Patterson AFB, Ohio.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2692, Autopilot Upgrade. This effort completes development of the new autopilot that began in FY 1984. Due to a late full scale development contract award (Sep 1984), a portion of the funds appropriated for this project were reprogrammed to higher priority efforts. As a result of late contract award, autopilot flight testing will now be accomplished in FY 1986. Funds were required to realign the funding profile with the planned development tasks.

Program Element: #11113F
DOD Mission Area: #113 - Airborne Strike

Title: B-52 Squadrons
Budget Activity: #3 - Strategic Programs

B. (U) Project: 3031, Avionics Software Development. This project accomplishes planning and initial studies for major software revisions in both the aircraft and ground test equipment resulting from operational requirements and flight test programs. Project is designed to perform future software developmental activities, such as incorporation of the Global Positioning System, into the B-52 operational routines. Project will also provide survivability assurance for operational software. This project supports Strategic Air Command (SAC) Statement of Operational Need (SON) 6-75 (validated), Offensive Avionics Modernization. In FY 1985, planning and study efforts will be initiated to modernize B-52 related software. Software modification initiatives will be identified and feasibility studies will commence. In FY 1986, beneficial initiatives will be carried into the laboratory for demonstration and suitability testing. This is a level of effort project and will show a minimum level of funding (approximately $5 million) across the Five Year Defense Plan beginning in FY 1987.

C. Project: 3156, Offensive Avionics System Hardening. This project is a new start in FY 1986. It will design and test changes to the B-52 avionics needed to [ ]
A 12 month design and test effort is envisioned followed by modification of the B-52 G/H aircraft.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

Budget Activity: 3, Strategic Programs
Program Element: 11113F, B-52 Squadrons

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): Major DT&E on the B-52 has finished. The Offensive Avionics System (OAS) completed DT&E/Initial Operational Test and Evaluation in October 1982. Limited subsystem testing was performed on the B-52 during the past year. This testing was for modifications to B-52 subsystems designed to improve subsystem reliability, maintainability, and operability.

(U) Testing was conducted on the Strategic Radar Upgrade (SRU). This test program was a combined DT&E/IOT&E effort which concluded in January 1984. Flight testing began in September 1983 and was completed ahead of schedule.

(U) The objective of the SRU program was to test and evaluate the operational effectiveness and suitability of the upgraded strategic radar. One B-52G, configured with the SRU, was tested at the Boeing Military Airplane Company (BMAC). Thirty objectives, across the spectrum of operational effectiveness and supportability, were examined. A single aircraft with preproduction equipment and a limited availability of test support equipment affected the evaluation. The results are summarized below:

(1) (U) Reliability of the system was undetermined. Constant modifications were made to the prototype design during the test program. Discrepancies were found in the antenna tilt and phase shifter systems. These problems are being addressed in an engineering change proposal currently in contract negotiation.

(2) (U) Maintainability and supportability were both rated deficient due to a lack of adequate test equipment. A flightline tester is being pursued to allow maintenance technicians to troubleshoot faults on the aircraft. Ratings in this area will improve when the test equipment is procured.

(3) (U) Operational effectiveness in both the terrain avoidance (TA) system and radar display were improved. Current TA system anomalies were eliminated permitting increased aircraft maneuvering capability. In addition to the tilt and phase errors mentioned above, a discrepancy was discovered in the frequency agility mode of operation. A fix has been identified for this problem. The fix will be incorporated in the production units and will be flight tested once a production radar kit is available.

(U) Based on operational testing conducted to date, the strategic radar modification is projected to meet the user's needs. The discrepancies identified during testing are being resolved and will be incorporated in the production units.

(U) The strategic radar development contractor is Boeing Military Airplane Company (BMAC). The DT&E manager is the Aeronautical Systems Division at Wright-Patterson AFB, OH. The IOT&E manager is Strategic Air Command (SAC). Air Force Operational Test and Evaluation Center (AFOTEC) will monitor both phases of testing. The contractor provided maintenance on the system during this phase of testing.

Budget Activity: 3, Strategic Programs
Program Element: 11113F, B-52 Squadrons

(U) B-52 Offensive Avionics System (OAS) Block 2 software testing has begun. This software is designed to incorporate changes driven by hardware development programs and software revisions made as a result of B-52 Integrated Weapon System (IWS) FOT&E. The Block 2 revision will contain both enhancements/optimizations and new capabilities. The enhancements/optimizations are: fixes from the FOT&E program; position only fix taking; optimization of memory, throughput, input/output; and optimization of inflight data recording. New capabilities are: Air Launched Cruise Missile classified data erase, improved Inertial Navigation System (INS) data processing, operator control of INS initialization and graceful reconfiguration.

(U) Block 2 software began flight test in August 1984. This program is being accomplished in building block fashion. Five separate and distinct tapes will be developed and flight tested. The first tape will incorporate navigation and strategic radar parameters. Tape 2 will add weapon delivery information, tapes 3 and 4 will add an internal cruise missile capability and tape 5 will be the final tape, delivered to the field.

(U) Development of a new autopilot for the B-52 is underway. The new autopilot is required to correct existing safety related deficiencies. System integration and ground testing will occur in FY 1985 with flight test scheduled for FY 1986. This new autopilot will also be used in the KC-135.

2. (U) Operational Test and Evaluation (OT&E): OT&E of the Integrated Weapon System (IWS) evaluates the operational effectiveness and suitability of the complete B-52G/H weapon system in an operationally realistic environment. Strategic Air Command's (SAC) IWS testing includes the Offensive Avionics System (OAS), the Air Launched Cruise Missile (ALCM), the Short Range Attack Missile (SRAM) and delivery of nuclear gravity weapons as an integrated weapon system. This test program is managed by HQ SAC and conducted by the 4201st Test Squadron. Test missions are flown from operational bombardment wings to support individual SAC programs such as GLOBAL CRUISE (ALCM), BULLET BLITZ (SRAM) and BUSY LUGGAGE (gravity weapons) as well as the overall IWS objectives:

(U) Provide inputs to HQ SAC planners in determining weapon system accuracy and reliability.

(U) Verify current employment concepts, tactics and techniques, and identify operational deficiencies.

(U) Verify adequacy of technical data and equipment currently used in maintenance, check-out and operation of the weapon system.

(U) Continue evaluation of those areas recommended as a result of previous testing.

Budget Activity: 3, Strategic Programs #3
Program Element: 11113F, B-52 Squadrons

(U) To date, operational performance demonstrated by FOT&E has met the advertised specifications in suitability, reliability and maintainability. Important results achieved from recent testing include the evaluation of the OAS's flex target option for ALCM and high latitude navigation.

3. Systems Characteristics: The following are general characteristics of the OAS/ALCM Integrated Weapon System (IWS) through July 1984:

WEAPON SYSTEM ACCURACY

Characteristic	Threshold	Demonstrated
SRAM CEP (Ft)		
ALCM CEP (Ft)		
Gravity Weapon CEP		
High Alt (Ft)		
Low Alt (Ft)		
Navigation Drift Rate (NM/Hr)		

Budget Activity: 3, Strategic Programs
Program Element: 11113F, B-52 Squadrons

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Last Flight, Strategic Radar Upgrade	February 1984	January 1984	Additional testing is planned to evaluate engineering changes made after Jan 1984. Testing will be done when a production unit is available in early 1986.
Begin flight tests on OAS Block II Software	September 1984	August 1984	Tape 1, Navigation and Strategic Radar Parameters
B-52 IWS FOT&E	FY 1984	FY 1984	Activity included SRAM launches, gravity weapon releases and counter-countermeasure testing

T&E Activity (Next 12 Months)

Event	Planned Activity	Remarks
Autopilot Flight Test	March-May 1986	Originally planned for FY 1985. Test schedule delayed due to program restructure
OAS Block II Software completes flight testing	July 1986	Tape 5, compilation of all preceding tapes
B-52 IWS FOT&E	October 1984-September 1985	Activity includes SRAM launches and gravity weapon releases

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11142F   Title: KC-135 Squadrons
DOD Mission Area: #113 - Airborne Strike   Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		6,714	4,010	968	4,002	Continuing	N/A
2214	Improved Aerial Refueling Systems (IARS)	141	4,010	968	4,002	Continuing	N/A
2469	KC-135R Modernization	6,573	0	0	0	0	94.8

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The IARS program funds a number of projects to improve upon the 1950s technology of the KC-135's air refueling system. Strategic Air Command's Required Operational Capability statement (validated Sep 80) identified deficiencies in fuel pressure regulation, fuel offload rates, disconnect capability, boom control authority, probe and drogue refueling equipment, and boom operator station equipment. The IARS program is phased over the years to investigate systems changes to alleviate the deficiencies.

3. (U) COMPARISON WITH FY 1985 Descriptive Summary: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	9,207	4,010	988		Continuing	N/A

In FY84, money was reprogrammed from project 2469 to an higher priority project; no impact. Funds were reprogrammed from project 2214 to a higher priority program. Inflation estimates lowered in FYs 86 and 87.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Not Applicable

6. (U) WORK PERFORMED BY: The primary contractors involved in the IARS are J.C. Carter Co. (Costa Mesa, CA), Sargent Fletcher Co. (El Monte, CA), XAR Industries (City of Industries, CA), and Dataproducts New England Inc. (Wallingford, CN). The in-house developing organizations are Air Force Systems Command's Aeronautical Systems Division (ASD), Wright-Patterson AFB, OH; 4950th Test Wing, Wright-Patterson AFB, OH; and 6150th Test Wing, Edwards AFB, CA.

Program Element: #11142F
DOD Mission Area: #113 - Airborne Strike

Title: KC-135 Squadrons
Budget Activity: #3 - Strategic Programs

7. (U) SINGLE PROJECT WITH FUNDING IN FY 1986:

(U) Project: 2214, Improved Aerial Refueling Systems (IARS)

A. (U) Project Description: This year's IARS effort focuses on development of an air refueling nozzle with disconnect capability independent of receiver aircraft systems and sensors to alleviate stress loading on the boom during air refueling contact. In addition, the project pursues improvements to the air refueling boom to provide increased boom control authority for an expanded air refueling "envelope" (area in which the receiver can maneuver while hooked up to the boom). These efforts will help to eliminate brute force disconnects and nozzle/receptacle binding, reduce receiver pilot fatigue, and enhance safety by expanding the limits of the envelope.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: A fuselage-mounted hose/reel drogue system was tested, including system stability with drogues of different drag values. The system was tested with A-37B, F-105F, A-7E, F-14A, F-18A, and S-3A aircraft. Test results of the overall system performance were very encouraging; Navy pilots especially were impressed with the improvements over the current KC-135 hose/drogue attachment. However, the location of the hose/reel pod (on the belly of the aircraft forward of the main landing gear) was not suitable for follow-on retrofit. Airframe modification would be difficult, and it required a long refueling hose.

(2) (U) FY 1985 Program: The tanker aerial refueling support/test equipment delivered in 1984 will be tested by Aeronautical Systems Division and the Strategic Air Command. A request for proposals (RFP) for design, development, and qualification of a prototype improved boom nozzle will be issued. An Air Force Systems Command KC-135 will be modified to test nozzles provided by separate contractors. Improved boom designs will be studied and wind tunnel tested, pointing toward FY1986 prototype development. Finally, results of a questionnaire from DOD air refueling users and air refueling vendors will be used to produce an air refueling performance and interface document.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The improved nozzles designed, built, and quality tested under contract will be tested by the government . Laboratory testing, at a cost of $100,000, will be followed by aircraft ground tests on a modified Air Force Systems Command KC-135. The Class II modification, based on similar work in 1982-83, and tests are estimated to cost $500,000. The remaining $380,000 requested is required to continue the FY 1985 initiation of design/development of an air refueling boom with improved boom control authority.

(4) (U) Program to Completion: The Improved Aerial Refueling Systems program is a continuing effort of individual projects that will not only improve the KC-135's air refueling system performance but also advance technology for future applications in this mission area. Future years' efforts include improved nozzle testing, test report, and aircraft demodification (FY 1987); install and flight test a prototype improved boom (FY 1987); design, development, and testing of boom operator station improvements (FY 1988); testing of boom operator station improvements and development of a pod-mounted hose/reel probe and drogue system (FY 1989); design and installation of a prototype air refueling receptacle for the KC-135 (FY 1990; and development of a boom-configured multi-point aerial refueling system (FY 1990).

C. (U) Major Milestones:

Milestones	Dates
(1) Fuselage-mounted hose reel:	
Contract award	March 1980
Flight testing complete	June 1984
(2) Air refueling support equipment:	
Contract award	September 1982
Hardware delivery	September 1984
(3) Improved nozzle:	
Draft request for proposals	December 1984
Complete flight testing	September 1986

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

Budget Activity: 3, Strategic Programs
Program Element: 11142F, KC-135R Modernization Program

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): DT&E for the KC-135R was combined with part of the operational test and evaluation (OT&E) program. Combined DT&E/OT&E was conducted at Wichita, Kansas, and Edwards AFB, California, from 4 August 1982 to 5 April 1984. The test aircraft flew 77 DT&E/OT&E sorties at Edwards and was evaluated for two months in the climatic laboratory at Eglin AFB, Florida. All elements of the more than 25 system/subsystems were evaluated with the exception of production engine struts and nacelles, which were installed before the aircraft was delivered to Strategic Air Command on 29 June 1984. Lack of production struts and nacelles had no impact on the DT&E/OT&E program.

(U) No major discrepancies were found during DT&E/OT&E. Because the quick start/auxiliary power unit system (QSAS) was the last system installed, limited time was available for QSAS testing. There was insufficient time in the planned test program to incorporate and retest changes mandated by QSAS service reports, so the QSAS was rated undetermined in the final DT&E/OT&E test report. Major areas of concern with the QSAS were slower start times at temperatures above 90°F and with strong, gusty, left quartering tailwinds. Those areas were tested by Strategic Air Command during follow-on test and evaluation (FOT&E) in July 1984; the results proved the operational reliability of the QSAS. However, because a number of service reports remained open, QSAS maintainability, logistics suitability, and availability remained undetermined as of the end of July 1984. Evaluation will continue as service reports are resolved.

(U) The test team rated the KC-135R's performance, handling, and aerial refueling excellent, reflecting significant improvements over the KC-135A. Mission capability was enhanced by the new and modified systems. Availability, reliability, and maintainability were rated satisfactory, with the engine showing the most improvement. Engine logistics reliability for the KC-135R was three times better than the KC-135A; engine system maintainability showed a fivefold improvement. Aircrew and maintenance personnel were impressed with the KC-135R's improved qualities.

(U) The following table depicts availability, reliability, and maintainability data for the KC-135R:

Availability	KC-135A	KC-135R
Full Mission Capable Rate	89.1%	89.1%
Mission Capable Rate	90.8%	95.0%

	KC-135A	KC-135R
Reliability		
Mission effectiveness	95.8%	98.0%
Mean time between maintenance (inherent)	1.2 hours	2.2 hours
Mean time between maintenance (corrective)	0.7 hours	1.4 hours
Maintainability		
Man-hours per flight hour	5.9 hours	3.1 hours
Mean man-hours to repair	3.9 hours	4.1 hours

(U) NOTE: Mean man-hours to repair for the KC-135R were driven high by time required to repair cracks in airframe panels and engine struts early in the test program and by adjustments to the high-speed trim modification to the autopilot. The cracks were peculiar to the KC-135A airframe used for the KC-135R test bed. The autopilot modification was subsequently deleted from production aircraft.

(U) The KC-135R Program Office, Aeronautical Systems Division, Air Force Systems Command (AFSC), Wright-Patterson AFB, Ohio, was the program manager. Boeing Military Airplane Company, Wichita, Kansas, was prime development contractor. AFSC was responsible for DT&E. The combined DT&E/OT&E team was made up of representatives from the Air Force Flight Test Center, Air Force Operational Test and Evaluation Center, Strategic Air Command, Air Force Logistics Command, and Air Training Command.

2. (U) Operational Test and Evaluation (OT&E): Follow-on operational test and evaluation (FOT&E) conducted by Strategic Air Command (SAC) on the KC-135R began 1 July 1984 and is scheduled for a one year period ending 30 June 1985. This FOT&E program includes ground and flight tests to evaluate system effectiveness and suitability in an operational environment. A primary goal will be to complete the evaluation of objectives remaining from previous testing. Additionally, the results of the FOT&E will be used to refine tactics and training and evaluate support equipment and technical orders. Specific test objectives are designed to:

(U) Evaluate base escape time, including engine start and minimum interval takeoff (MITO) capabilities.

(U) Assess Strategic Air Command's training program for KC-135R aircrew qualification.

(U) Evaluate operational capability in hot and cold weather.

(U) Evaluate the maintainability and reliability of the quick start/auxiliary power system and environmental control system.

(U) Assess the adequacy of maintenance and crew technical orders.

(U) The overall list of test objectives is contained in the Strategic Air Command (SAC) FOT&E test plan published 29 June 1984.

(U) Due to quick start/auxiliary power system (QSAS) design deficiencies, Aeronautical Systems Division issued a 30 extension (30 June 1984 to 29 July 1984) to the DT&E/OT&E of that system. This additional evaluation period allowed SAC time to insure the QSAS capability met operational needs. To date, the operational performance demonstrated during testing meets the advertised specifications in suitability, reliability and maintainability. The QSAS test extension was complete 26 July 1984, and the system was accepted by the Air Force. Although it meets specifications, the QSAS still has numerous outstanding service reports which affect the evaluation of system availability, reliability, and maintainability.

3. (U) System Characteristics:

Characteristic	Objective/Threshold	Demonstrated
Maximum takeoff gross weight	322,500lbs	322,500lbs
Fuel capacity	203,000lbs	203,288lbs
Takeoff ground roll (90° F, sea level, air conditioning on)	9,000ft	8,100ft
Critical field length (90° F, sea level, air conditioning on)	11,000ft	10,400ft
Fuel savings	25%	27%
Engine noise	106 decibels	97 decibels

Budget Activity: 3, Strategic Programs
Program Element: 11142F, KC-135R Modernization Program

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Infrared signature evaluation	July 1984	July 1984	
High pressure altitude and temperature test of quick start/auxiliary power system (QSAS)	July 1984	July 1984	At Ellsworth Air Force Base, South Dakota
Low pressure altitude and high temperature test of QSAS	July 1984	July 1984	At Castle Air Force Base, California
Environmental (noise) evaluation	September 1984	Postponed	Weather cancel, test to be rescheduled in Spring 1985.
Minimum interval takeoff (MITO) testing	December 1984	December 1984	At Edwards Air Force Base, California
Standard central air data computer testing	December 1984		Postponed until March 1985 for continuing evaluation by KC-135 System Program Manager

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Cold weather testing	January - February 1985	At Eilson Air Force Base, Alaska
FOT&E complete	June 1985	
FOT&E report due to Strategic Air Command	September 1985	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11213F
DOD Mission Area: #111 - Land-Based Strike

Title: Minuteman Squadrons
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		4,907	4,672	31,203	95,030	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Minuteman weapon system became operational in the 1960s and now consists of 450 Minuteman II and 550 Minuteman III intercontinental ballistic missiles deployed in hardened underground silos. Minuteman has served as a prime nuclear deterrent force for the United States for 22 years and is projected to maintain this role into the next century. The program element (PE) provides improvements and modifications to the Minuteman force to enhance its contribution to strategic deterrence.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,907	4,672	32,932		Continuing	N/A
Missile Procurement	30,588	14,829	22,748		TBD	TBD

(U) Difference in FY 1984 Missile Procurement because FY 1985 Descriptive Summary included $30.588 million for Command, Control, Communications Integration which was associated with FY 1983 RDT&E funds. These Missile Procurement funds are not listed in paragraph 4 as only investment appropriations associated with FY 1984-FY 1987 RDT&E are shown.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Missile Procurement:						
Funds	0	14,794	22,597	29,490	TBD	TBD
Quantities	Not Applicable					
Operations and Maintenance:						
Funds	0	15,075	14,802	21,706	TBD	TBD

(This funding reflects only that Missile Procurement and Operations and Maintenance associated with RDT&E programs.)

5. (U) RELATED ACTIVITIES: Advanced Strategic Missile Systems, PE #63311F, is a program which develops ballistic missile technology for operational and future intercontinental ballistic missile (ICBM) applications. ICBM Modernization, PE #64312F, is developing systems for the next generation missiles. Duplication of effort is avoided by assigning both

of these programs and Minuteman development activities to a single organization, the Ballistic Missile Office. Strategic Air Command (SAC) Communications, PE #11316F, is developing and procuring the SAC Digital Network (SACDIN), which will be delivered as government-furnished equipment to the Command, Control, Communications (C^3) Integration program for integration into the Minuteman launch control centers.

6. (U) WORK PERFORMED BY: The primary contractors are TRW, Redondo Beach, CA (Program Support-Systems Engineering/ Technical Assistance), Acurex, Mountain View, CA (Passive Decoy Penetration Aid Studies), Tracor, Austin, TX (Deployment System Penetration Aid Studies), and Rockwell International, Anaheim, CA (Accuracy Incentives). The responsible Air Force agency is Air Force Systems Command's Ballistic Missile Office, Norton Air Force Base, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 11213F, Minuteman Squadrons

A. (U) Project Description: Software development starts in FY 1986 to support a new computer system to replace field- and depot-level automatic test equipment for which vendors will no longer provide supply and maintenance support. Program Support includes funding for systems engineering/technical assistance and all operating costs (collateral testing, analyses, travel, etc.) in support of Minuteman programs at the Ballistic Missile Office. Continuing technical expertise for planning, analysis, design, test, and associate systems engineering support is necessary to develop and prove prototypes of improvements to the operational system in accordance with approved program direction.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: This program resolved problems encountered in FY 1984 during assembly and checkout of Minuteman Extended Survivable Power (MESP) equipment and supported the Guidance Upgrade and C^3 Integration programs. The initial operational capability for the MESP program was in May and Guidance Upgrade tape deployment compled in July.

(2) (U) FY 1985 Program: This program will support the C^3 Integration Phase II (SACDIN) program and will resolve any problems encountered during FY 1985 assembly and checkout of MESP equipment. It will conduct guidance studies for accuracy improvement, reentry vehicle studies to define required penetration aids characteristics, and program planning for the Minuteman II Stage 3 remanufacture program.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: This program will resolve problems found during FY 1986 assembly and checkout of C^3 Integration Phase II (SACDIN) equipment. It will conduct guidance studies for accuracy improvement, reentry vehicle studies to refine required penetration aids characteristics, and program planning for the Minuteman III Penetration Aids program which will take penetration aid components developed in the

Advanced Strategic Missile Systems program and adapt/integrate them for use on Minuteman III. Development begins for the software used with the replacement Minuteman test equipment. The category II cost estimate, reviewed in November 1984, was arrived at through the use of program office assessments utilizing past acquisition history of similar efforts, Technical Analysis and Cost Estimate studies, and data obtained from program office support functions.

(4) (U) Program to Completion: Test Equipment software development continues through 1989, and Minuteman III Penetration Aids development begins in 1987 and ends in 1990. Program Support is a continuing program.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Command, Control, Communications (C^3) Integration Phase II Initial Operational Capability (IOC)	January 1986
(2)	(U)	Minuteman Extended Survivable Power Full Operational Capability (FOC)	September 1986
(3)	(U)	C^3 Integration Phase II FOC	April 1987
(4)	(U)	Minuteman III Penetration Aids Full Scale Development	FY 1987
(5)	(U)	Minuteman Test Equipment Software Complete	FY 1989
(6)	(U)	Minuteman III Penetration Aids IOC	FY 1991
(7)	(U)	Minuteman III Penetration Aids FOC	FY 1992

(Milestones were not listed in the FY 1985 Descriptive Summary.)

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11312F — Title: Post Attack Command and Control System
DOD Mission Area: #331 - Strategic Command and Control — Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		4,455	799	5,163	8,261	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To provide a survivable command and control facility for the Single Integrated Operation Plan (SIOP) Commanders in Chief (CINCs) that will support the National Command Authority during all phases of a general war. Supports activities currently underway involving all the aircraft of the Worldwide Airborne Command Post System (WWABNCP), including Commander in Chief, Europe (CINCEUR); Commander in Chief, Strategic Air Command (CINCSAC); Commander in Chief, Atlantic (CINCLANT); and Commander in Chief, Pacific (CINCPAC).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,455	799	927		Continuing	N/A
Aircraft Procurement	79,372	71,525	159,708		Continuing	N/A

FY 86 increase in RDT&E reflects funds added to support WWABNCP Replacement concept studies and Regency Net.
FY 86 reduction in Aircraft Procurement funding reflects Air Force deferral of GWEN, NDS, DRE AND Regency Net.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
Funds	71,972	71,525	82,256	235,677	Continuing	N/A
Quantities	Not Applicable					

5. (U) RELATED ACTIVITIES: The following Program Elements support the Worldwide Airborne Command Post System: Strategic Air Command Communications, PE 11316F; Air Force Satellite Communications Program, PE 33601F; System Survivability, PE 64711F; Electromagnetic Radiation Test Facilities, PE 64747F; National Emergency Airborne Command Post, PE 32015F; Air Force Support to Minimum Essential Emergency Communications Network, PE 33131F; Milstar, PE 33603F; Peacekeeper, Minuteman Common Airborne Launch Control Center (ALCC), PE 11215F; and Nuclear Detonation (Nudet) Detection System (NDS), PE 12433F.

Program Element: #12313F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Ballistic Missile Tactical Warning/Attack Assessment System
Budget Activity: #3 - Strategic Programs

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: #12313, Ballistic Missile Tactical Warning/Attack Assessment (TW/AA) System

A. (U) Project Description: This program will provide the management framework through which the Air Force will apply coordinated oversight of the acquisition and interface of missile warning systems. New TW/AA-related systems defined in the project are later transferred to separate Program Elements for development, acquisition and deployment. Integration will be ensured through the development of technical standards for sensor configuration, implementation of protocols for communications interfaces and by development of detailed plans for command center processing and utilization of missile warning information. Management of the TW/AA assets as an integrated system is necessary to ensure accurate, timely, and unambiguous warning and assessment information to support force survivability actions and national decision making.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Engineering efforts supported integration of new or improved sensors and communications subsystems with the North American Aerospace Defense (NORAD) Cheyenne Mountain Complex (NCMC) and with other users of TW/AA information. Emphasis was placed on integration of the Southeast and Southwest PAVE PAWS systems, and the Ballistic Missile Early Warning System (BMEWS) upgrade. Engineering design efforts were initiated for a TW/AA Survivable Communications Interface System (SCIS) and NORAD's Command and Control System (NCCS) upgrade. (Note: NCCS transfers to PE 12310F in FY 1985.)

(2) (U) FY 1985 Program: Pre-contract development work, including a design definition phase, will continue on the SCIS system acquisition. (Note: SCIS will transfer to PE 12310F in FY 86.) Preliminary analysis of European warning requirements will be accomplished and assessment made of support requirements for a worldwide TW/AA capability for crisis and force management.

(3) (U) FY 1986 Planned Program and Basis for 1986 RDT&E Request: Preliminary concept definition work will begin on a survivable ground-based missile warning/attack assessment system to serve as a cost-effective alternative or complement to space based warning systems. In addition, pre-contract development work will be accomplished for a NORAD standard display system. Funding cited reflects estimated level of effort on this project; no formal estimate is applicable.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

for a Worldwide Airborne Command Post Replacement Program; and the integration of a new High Frequency radio system called Regency Net. This advanced waveform system will require R&D to ensure proper performance of all the aircraft systems.

(4) (U) Program to Completion: This is a continuing program. The EMP Engineering Surveillance program is a continuing program, as survivability of the EC-135 fleet must be insured. Specific tasks necessary to conduct this effort will be identified as they occur. Examples of possible tasks include analysis of future upgrade projects designed to keep the Worldwide Airborne Command Post (WWABNCP) fleet compatible with the evolving Command, Control Communications and Intelligence (C3I) structure, development of improved airborne C2 systems to improve the message dissemination and force management capabilities of the WWABNCP system and conducting test planning and preliminary analysis for EC-135 system level Electromagnetic Pulse (EMP) tests.

C. (U) Major Milestones:

	Milestones		Dates
(1)	(U) Ultra-High Frequency Line of Sight (UHF-LOS) Preliminary Design Review		November 1984
(2)	(U) Peacekeeper/Minuteman Common Airborne Launch Control Center (ALCC) Critical Design Review	* (December 84)	January 1985
(3)	(U) Ultra-High Frequency Line of Sight Critical Design Review	* (December 84)	May 1985
(4)	(U) EC-135 System Level Electromagnetic Pulse (EMP) Test Preliminary Plan		September 1985
(5)	(U) Initial Aircraft Installation of UHF-LOS System on Worldwide Airborne Command Post (WWABNCP)		June 1986

* Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(2) (U) Peacekeeper/Minuteman Common Airborne Launch Control Center (ALCC) Preliminary Design Review slipped due to delayed development of hardware specifications. No impact to installation schedule.

(3) (U) Ultra-High Frequency Line of Sight Critical Design Review slipped due to late award of contract.

PE #: 11312F

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11316F
DOD Mission Area: #333 - Strategic Communications

Title: SAC Communications
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		12,566	3,046	10,625	620	0	154,301
1136	SAC Digital Network (SACDIN)	3,093	261	259	120	0	130,121
2869	Aircraft Alerting Communications Electromagnetic Pulse (EMP) (AACE) Upgrade	9,473	2,785	4,600	0	0	17,914
3130	Super High Frequency (SHF) Satellite Communications (SATCOM)	0	0	5,766	500	0	6,266

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The SACDIN program will upgrade and modernize SAC's obsolescent (1950's technology) printed-copy command and control communications system. The current system is self-contained (and, therefore, isolated and vulnerable) with one-way, non-secure transmission at its lowest echelons. SACDIN will provide important interfaces to other command & control systems while achieving full two-way, secure communications with enhanced survivability. The AACE Upgrade program will provide hardened communications shelters, consoles and radiation detectors to protect critical command, control and communications systems against disruptive EMP effects caused by nuclear explosions. The SHF SATCOM project is an FY 1986 new start which will relay Air Force SATCOM messages over the Defense Satellite Communications System III satellite to receivers located at Intercontinental Ballistic Missile launch control centers. The SHF communications link is more jam-resistant and survivable than the existing UHF links.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	12,375	1,546	3,054		Continuing	Continuing
Other Procurement	121,714	14,521	8,791		1,764	179,437

FY 1985: The increase in RDT&E and decrease in Other Procurement was due to a restructure of the AACE program.
FY 1986: The increases in RDT&E and Other Procurement are due to a restructure of the AACE program and the SHF SATCOM program, which is a new start in FY 1986.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement:						
Project 3130 (SHF SATCOM)						
Funds	0	0	0	8,888	17,183	26,071
Quantities		Not applicable				
Other Procurement:	116,443	2,775	13,814	16,085	0	181,764
Project 1136 (SACDIN)						
Funds	116,443	2,775	1,129	0	0	152,994
Quantities		Not applicable				
Project 2869 (AACE)						
Funds	0	0	12,685	16,085	0	28,770
Quantities		Not applicable				

5. (U) RELATED ACTIVITIES: Funding in Program Element 11213F will integrate SACDIN into the Minuteman and Peacekeeper weapon systems. The common-user Defense Data Network (the Defense Communications Agency's Program Element 33126K) will provide the major network trunking support for the SAC Digital Network (SACDIN).

6. (U) WORK PERFORMED BY: Electronic Systems Division, Hanscom Air Force Base, MA (total program management); MITRE Corporation, Bedford, MA (technical support); International Telephone and Telegraph (ITT), Defense Communications Division, Nutley, NJ (SACDIN prime contractor); and BDM Corporation, Albuquerque, NM (prime contractor for the Aircraft Alerting Communications Electromagnetic Pulse (EMP) (AACE) Upgrade program). Contractor for the SHF SATCOM project has not yet been selected.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 1136, SAC Digital Network (SACDIN). The SACDIN program includes the design, acquisition and implementation of a command and control data communications system for the SAC Commander-in-Chief. The system will significantly improve current communications capabilities from both operational and maintenance standpoints. SACDIN will replace SAC's present communications processors and key elements of its transmission system. It will interface with the system which provides the large wallscreen displays in the Headquarters SAC Command Post. ITT Corporation is the prime contractor, with total system performance responsibility. Maximum possible use is being made of off-the-

shelf equipment. Hardware will be modified and new hardware/software procured only where operational requirements demand. Initial Operational Test and Evaluation and limited production were started in FY 1984. SAC Digital Network (SACDIN) maintenance training will begin in Fiscal Year 1985 at Keesler AFB, MS. Initial Operational Capability will be achieved in FY 1986, with installation continuing base by base through the end of the fiscal year. RDT&E funding is for operation of the program office; the Other Procurement funding is for systems engineering support during installation. Costs are based upon a negotiated production contract proposal. Installation will continue until Full Operational Capability (FOC) of all 135 locations is achieved in July 1987.

B. (U) Project: 2869, Aircraft Alerting Communications Electromagnetic Pulse (EMP) (AACE) Upgrade Program. The AACE program consists of two separate development efforts: EMP protection and EMP detection. EMP-hardened shielded enclosures and consoles will be developed to protect critical command, control and communications equipment at SAC aircraft wing command posts. The AACE-developed EMP Detection System will positively identify a nuclear-caused electromagnetic pulse. If an EMP is detected and unhardened communications systems disrupted, the shielded enclosures and AACE consoles will enable command posts to continue to communicate with higher headquarters through several means and relay any messages to aircrew members via EMP-protected radios and telephones. A competitive full scale development contract for the shielded enclosures was awarded in October 1984. In FY 1985 the contractor will develop a prototype shielded enclosure. The unit will be shipped to Kirtland AFB, NM for Developmental Test and Evaluation. In FY 1986 operational testing of the shielded enclosure will be completed and, assuming satisfactory results, a production option exercised. Approximately half the shielded enclosures will be bought with FY 1986 funds, with installation beginning during the 2nd Quarter of FY 1986. Development of the EMP detector is scheduled to begin in FY 1986. The remaining shielded enclosures and all the EMP detectors will be purchased with FY 1987 funds. AACE installation will continue through the 4th Quarter of FY 1989.

C. (U) Project: 3130, Super High Frequency (SHF) Satellite Communications (SATCOM). Soft SHF antennas and SHF/Ultra High Frequency (UHF) downconverters will be installed at ICBM Launch Control Centers (LCCs). The resulting UHF signal will be interfaced with existing UHF equipment for message processing. This will enhance the communications link to the LCCs by taking advantage of the jam-resistance and survivability of the Defense Satellite Communications System (DSCS) III satellite. This project is an FY 1986 new start. FY 1986 will include the start and completion of concept exploration and the accomplishment of a competitive demonstration/validation phase. System requirements will be defined and specification documents will be written. An engineering model will be deployed to a nonoperational LCC simulator/site and tested. Starting in FY 1987, thru FY 1990, units will be produced, deployed, installed, and tested at the 100 ICBM LCCs.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

Budget Activity: 3, Strategic Programs
Program Element: 11316F, Strategic Air Command Digital Network (SACDIN)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): During the development phase, individual subsystems were fabricated and assembled into a SACDIN prototype. This prototype was tested to determine hardness and security characteristics and to insure that the subsystems properly functioned together. Simulation was used to exercise the prototype during system tests. The DT&E testing period began in the fourth quarter, fiscal year 1979, and has continued into fiscal year 1985. International Telephone and Telegraph (ITT) Defense Communications Division, Nutley, NJ, the prime contractor, is conducting the DT&E. The contractor and Strategic Air Command (SAC) personnel operate and maintain the system during DT&E.

The prototype consists of the same hardware as the production units (keyboards, printers, processors). After in-plant testing, this equipment was installed at Offutt Air Force Base, NE and Vandenberg Air Force Base, CA. DT&E has been conducted using the actual interfaces to external communications and data systems. All DT&E will be completed prior to the full production decision. Acceptance testing and checkout will be conducted during production and deployment.

2. (U) Operational Test and Evaluation (OT&E): The Air Force Operational Test and Evaluation Center (AFOTEC) conducted the first Initial Operational Test and Evaluation (IOT&E) of SACDIN during 30 July through 7 September 1984. This IOT&E addressed system and human response times, system control, security, interoperability, human factors, safety, reliability, availability, and maintainability. The IOT&E was conducted at Vandenberg AFB, CA; Offutt AFB, NE; and the ITT contractor facility, Nutley, NJ. The overall SACDIN system was found to be deficient, mainly because of faults in the software. The deficiencies were judged correctable, but additional DT&E testing will be done to evaluate the operational suitability of SACDIN as corrections are made. A second IOT&E is planned prior to full production and deployment of the system.

AFOTEC is monitoring the DT&E continuing at the ITT contractor facility, Nutley, NJ, and Offutt AFB, NE, and will conduct the second IOT&E during the 1st quarter, fiscal year 1986.

3. (U) Systems Characteristics:

Characteristic	Threshold	Demonstrated
Mean Time Between Maintenance		
Missile Base Communications Processor	1125 hours	1945 hours *
Hardened User Terminal Equipment	2250 hours	3205 hours *

Budget Activity: 3, Strategic Programs
Program Element: 11316F, Strategic Air Command Digital Network (SACDIN)

Characteristic	Threshold	Demonstrated
Undetected Character Error Rate	10^{-8}	10^{-8}
Response Time	15 seconds	8 seconds avg **
Confidence Level for Delivery of Emergency Action Message	99.73%	99.9%
System Functional Availability	99.5%	99.97% ***

* From Reliability Growth Program (reaching maturity).

** Demonstrated by test at approximately 90% peak minute load; 110% peak hour load.

*** From Reliability Growth Program (reaching maturity).

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
DT&E external interface tests	FY 3/83	Feb 84	Delay due to software development
DT&E system tests	FY 1/84	Continuing	Delay due to software debugging.
Completion of first IOT&E	FY 1/84	Sep 84	Tests results rated SACDIN deficient

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Completion of DT&E testing	FY 4/85	
Completion of second IOT&E	FY 1/86	Second IOT&E will start following correction of deficiencies from first IOT&E

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12310F
DOD Mission Area: #391 - Strategic Information Systems

Title: NCMC - TW/AA Systems
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		21,213	23,834	57,445	67,857	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element funds the replacement of Tactical Warning/Attack Assessment (TW/AA) command, control, and communications systems located in the North American Aerospace Defense Command (NORAD) Cheyenne Mountain Complex (NCMC). NORAD's mission to provide reliable warning and assessment of aerospace attack is[

] Software interconnectivity results in hundreds of hours of system testing for small software changes.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	23,413	23,834	47,990		Continuing	N/A
Other Procurement	1,471	12,207	14,377		Continuing	N/A

(U) FY 1986 RDT&E funds were increased $6.8 million to compensate for a Congressional directed reduction in FY 1984. $2.7 million was also added in FY 1986 to begin replacement of the NORAD Command and Control System (NCCS).

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	1471	13,300	15,819	3,148	Continuing	N/A
Quantities	Not Applicable					

PE #: 12310F

5. RELATED ACTIVITIES: The NORAD Cheyenne Mountain Complex (NCMC) interfaces with virtually all currently operational surveillance and warning systems: NCMC - Space Defense Systems (PE #12311F), [ ] Ballistic Missile Early Warning System (BMEWS) (PE #12423F), Submarine Launched Ballistic Missile Radar Warning System (PAVE PAWS) (PE #12432F), SPACETRACK (PE #12424F), and Joint Surveillance System (PE #12323F).

6. (U) WORK PERFORMED BY: The effort is managed by Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA. The Communications System Segment-Replacement (CSS-R) contractor is GTE Sylvania, Needham, Mass. Federal Contract Research Center (FCRC) support is provided by MITRE, Corp., Bedford, MA. Contractors for other efforts have not been selected.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12310F, NCMC - TW/AA Systems

A. (U) Project Description: This program is divided into two major efforts: (1) The Communications System Segment Replacement (CSS-R) program which provides for replacement of equipment that processes all communications in and out of the NCMC. (2) GRANITE SENTRY is replacement program for the existing NORAD Command and Control System (NCCS) in the Cheyenne Mountain Complex. These two systems provide support for atmospheric and ballistic missile warning and attack assessment, and communication for the atmospheric and space defense mission. Each system will be acquired in evolutionary blocks. As each block is developed, tested, and performance verified it will be turned over to NORAD. This will provide the user measurable improvements in operational capability over the entire acquisition period.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Competitive design efforts were completed for the CSS-R. The design includes modular, commercial, state-of-the-art hardware and software, automatic fault recovery, and techniques to enhance error isolation. A contract was awarded for full scale development in July 1984.

(2) (U) FY 1985 Program: CSS-R software development, coding, and testing for on-line circuit monitoring and recording, semi-automatic switching of spare circuit components and test equipment, and circuit restoration will continue. A Critical Design Review (CDR) of the first block will be held in January 1985. Following CDR the second CSS-R block of effort will be initiated for the hardware and software design of the automatic verification and routing of missile warning message traffic.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The initial set of Communications System Segment-Replacement (CSS-R) operational equipment will be delivered and installation will begin. Critical Design Review will be conducted for the second block. The third block, acquisition of the software for the remaining real time and common user functions, will be initiated. Development of GRANITE SENTRY will begin. GRANITE SENTRY provides for the replacement of the NORAD Command and Control System for Tactical Warning/Attack Assessment. Contracts will be awarded to at least two contractors for the competitive design of GRANITE SENTRY.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	CSS-R Concept Definition contract award		July 1983
(2)	(U)	CSS-R Development contract award	*(May 1984)	June 1984
(3)	(U)	CSS-R Critical Design Review Block A		January 1985
(4)	(U)	CSS-R Block B initiation		June 1985
(5)	(U)	CSS-R Block C initiation		June 1986
(6)	(U)	GRANITE SENTRY Concept Definition contract award		3Q FY 86
(7)	(U)	CSS-R Initial Operational Capability (IOC)	*(October 1986)	3Q FY 87

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) Explanation of Milestone Changes

(2) Contract Award delayed because of lengthy negotiations.
(7) IOC reflects negotiated contractual effort.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12311F
DOD Mission Area: #391 - Strategic Information Systems

Title: NCMC - Space Defense Systems
Budget Activity: #3 - STRATEGIC PROGRAMS

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		46,964	37,441	72,996	64,932	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A Space Defense Command and Control System (SPADCCS) is needed to satisfy Presidential and Secretary of Defense directives to improve, in a balanced manner, the space defense capability of the United States. Current space defense operations lack real-time response and can not satisfy new operational requirements. This program element supports development of the following SPADCCS systems: the Space Defense Operations Center (SPADOC) for control of all United States' space defense and space surveillance activities, the Prototype Mission Operations Center (PMOC) for anti-satellite test activities, the Mission Control Center (MCC) for anti-satellite operations, the North American Aerospace Defense (NORAD) Space Surveillance Center (NSSC) upgrade for orbit parameter computations, and the associated communications networks.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	46,964	52,253	70,478		Continuing	N/A
Procurement	23,607	28,420	67,489		Continuing	N/A

EXPLANATION: (U) FY 1985 RDT&E and Procurement were reduced by Congressional action. FY 1986 RDT&E increase due to restructuring of MCC program to begin in FY 1986. FY 1986 Procurement reduced to reflect latest SPADOC cost estimate.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	25,895	27,182	45,220	21,107	Continuing	N/A
Quantities	Not Applicable					

PE #: 12311F

5. (U) RELATED ACTIVITIES: This program is part of the Space Defense Systems Program which include four functional areas: space survivability, space surveillance, anti-satellite, and command and control. Those program elements (PEs) directly related are the following: PE 12424F, SPACETRACK; PE 63438F, Satellite System Survivability; and PE 64406F, Space Defense System (ASAT). The Space Defense Operations Center (SPADOC) will provide survivability and warning information to the Consolidated Space Operations Center, PE 35130F.

6. (U) WORK PERFORMED BY: Air Force System Command's (AFSC) Space Division in Los Angeles AFS, CA, is responsible for overall management of the Space Defense Command and Control System development. The Prototype Mission Operations Center has been developed by Boeing, Seattle, WA. Boeing will also be the major contractor for the ASAT Mission Control Center. AFSC's Electronic Systems Division, Hanscom AFB, MA is the acquisition/program management agency for the SPADOC effort. Ford Aerospace Communications Corporation, Colorado Springs, CO is the prime contractor; IBM, Gaithersberg, MD is the major hardware subcontractor; and TRW, Colorado Springs, CO is the major software subcontractor on the SPADOC effort. System engineering contractors are Science Applications Incorporated, La Jolla, CA; Aerospace Corporation, Los Angeles CA; and MITRE Corporation, Burlington, MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12311F, NCMC - Space Defense Systems

A. (U) Project Description: The Space Defense Operations Center (SPADOC) development will provide an integrated command and control capability for space defense systems. It has evolved from a totally manual system in 1979 to today's semi-automatic capability. The acquisition approach for SPADOC Phase IV is to acquire it in three separate and overlapping procurement blocks. Each block is designed to give the user a measurable increase in capability. SPADOC IV Block A will establish the basic system architecture and executive software. SPADOC IV Block B will provide increased space object catalog capability, both in overall data and processing speed to satisfy the requirements imposed by the worldwide increased use of space. SPADOC IV Block C will incorporate the semi-automated space warning and countermeasure management functions as well as evasive maneuver detection and strike assessment functions into the overall space operations capability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The Prototype Mission Operations Center, completed in FY 1983, supported anti-satellite system development, test and evaluation. SPADOC IV Block A development continued. The initial suite of

SPADOC IV computational hardware and associated peripherals was delivered and installed in the contractor's facility. Newly developed system software was tested. Initial preparations were made to begin installation of SPADOC IV equipment in the Off-Site-Test-Facility and the Cheyenne Mountain Complex. System definition efforts for SPADOC IV Block B procurement were initiated. The Space Defense Operations Center (SPADOC) IV Block B will provide the user improved hardware and software necessary to satisfy the catalog function associated with the increasing space object population.

(2) (U) FY 1985 Program: SPADOC IV Block A efforts will be completed and Initial Operational Capability will be achieved. The contract for SPADOC IV Block B will be awarded and software development will be initiated. The SPADOC IV B efforts will primarily address space object management. Automated message handling and data base management systems will be developed to provide the necessary command and control interface to the National Command Authority. The SPADOC IV B contract will also procure the hardware necessary to upgrade the North American Aerospace Command (NORAD) Space Surveillance Center (NSSC) computer. NSSC software will be accomplished as part of the SPADOC IV B. The NSSC function provides the space catalog function. The Prototype Mission Operations Center (PMOC) will continue supporting the Anti-satellite system development during flight tests.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Critical Design Review for SPADOC IV Block B will take place. Preliminary and formal qualification testing for hardware and software will be accomplished. The Prototype Mission Operations Center will continue to support anti-satellite flight testing. The effort to upgrade the PMOC to the fully operational Anti-Satellite (ASAT) Mission Control Center (MCC) capability will begin. The SPADOC IV Block C contract will also be awarded. The SPADOC IV Block C acquisition will complete the NSSC software development as well as the interface between SPADOC and the MCC.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Aerospace Defense Command Statement of Operational Need 3-79		December 1980
(2)	(U)	ASAT Mission Element Need Statement		April 1981
(3)	(U)	SPADOC IV Concept Definition Contract		December 1981
(4)	(U)	SPADOC IV A Contract Award		April 1983
(5)	(U)	SPADOC IV A Critical Design Review		November 1983-March 1984
(6)	(U)	SPADOC IV B Contract Award	*(January 1985)	March 1985
(7)	(U)	SPADOC IV A Initial Operational Capability	*(June 1985)	August 1985
(8)	(U)	SPADOC IV B Critical Design Review	*(November 1985)	February 1986
(9)	(U)	SPADOC IV C Contract Award		March 1986

	Milestones		Dates
(10) (U)	SPADOC IV C Critical Design Review		3Q FY 1986
(11) (U)	SPADOC IV B Initial Operational Capability		4Q FY 1986
(12) (U)	SPADOC IV C Initial Operational Capability	*(2Q FY 1988)	4Q FY 1988

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) Explanation of Milestone Changes

Delay is due to Congressionally directed fund reduction in FY 1985. A program restructure was necessary.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12313F

DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Ballistic Missile Tactical Warning/Attack Assessment System

Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,875	3,214	2,655	3,187	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides system engineering and design analysis support for the nation's ballistic missile Tactical Warning and Attack Assessment (TW/AA) system. This effort was initiated to implement the recommendations of the Oct 1980 report to the Committee on Armed Services, United States Senate, which addressed, "Recent False Alerts from the Nations' Missile Attack Warning System". The report recommended the Secretary of Defense consolidate management of essential TW/AA resources under a single commander and provide a centralized management structure for TW/AA acquisition programs. The objectives of this program are to promote fully coordinated management and technical interoperability in the acquisition of new or upgraded TW/AA systems and prevent duplication of effort between programs.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,875	3,214	2,940		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The work in this program insures the integration and coordination of development, acquisition and deployment efforts for missile warning sensor systems, communications systems and command centers. This program is related to all projects which support the Air Force tactical warning and attack assessment mission.

6. (U) WORK PERFORMED BY: Air Force Systems Command's Electronic System Division (ESD) Hanscom AFB, MA, is responsible for overall management of this program. ESD coordinates program engineering efforts with Space Command's Deputy Chief of Staff (DCS) for Systems Integration (SY) to insure user's requirements are met and no duplicative projects are undertaken. Program funds pay for technical engineering support, including support from the Mitre Corporation which is a Federal Contract Research Center (FCRC), headquartered in Bedford, MA.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: #12313, Ballistic Missile Tactical Warning/Attack Assessment (TW/AA) System

A. (U) Project Description: This program will provide the management framework through which the Air Force will apply coordinated oversight of the acquisition and interface of missile warning systems. New TW/AA-related systems defined in the project are later transferred to separate Program Elements for development, acquisition and deployment. Integration will be ensured through the development of technical standards for sensor configuration, implementation of protocols for communications interfaces and by development of detailed plans for command center processing and utilization of missile warning information. Management of the TW/AA assets as an integrated system is necessary to ensure accurate, timely, and unambiguous warning and assessment information to support force survivability actions and national decision making.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Engineering efforts supported integration of new or improved sensors and communications subsystems with the North American Aerospace Defense (NORAD) Cheyenne Mountain Complex (NCMC) and with other users of TW/AA information. Emphasis was placed on integration of the Southeast and Southwest PAVE PAWS systems, and the Ballistic Missile Early Warning System (BMEWS) upgrade. Engineering design efforts were initiated for a TW/AA Survivable Communications Interface System (SCIS) and NORAD's Command and Control System (NCCS) upgrade. (Note: NCCS transfers to PE 12310F in FY 1985.)

(2) (U) FY 1985 Program: Pre-contract development work, including a design definition phase, will continue on the SCIS system acquisition. (Note: SCIS will transfer to PE 12310F in FY 86.) Preliminary analysis of European warning requirements will be accomplished and assessment made of support requirements for a worldwide TW/AA capability for crisis and force management.

(3) (U) FY 1986 Planned Program and Basis for 1986 RDT&E Request: Preliminary concept definition work will begin on a survivable ground-based missile warning/attack assessment system to serve as a cost-effective alternative or complement to space based warning systems. In addition, pre-contract development work will be accomplished for a NORAD standard display system. Funding cited reflects estimated level of effort on this project; no formal estimate is applicable.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12323F
DOD Mission Area: #333 - Strategic Communications

Title: TW/AA Interface Network
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	1,468	6,952	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: [

]

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	0	0	0	980	Continuing	N/A
Quantities	Not Applicable					

5. (U) RELATED ACTIVITIES: This program is related to all programs which support the Air Force TW/AA mission since it insures the integration of the various communications used to transmit TW/AA data between missile warning sensor systems and command centers.

6. (U) WORK PERFORMED BY: The effort will be managed by Air Force Systems Command's Electronic Systems Division located at Hanscom AFB, MA. Prime contractors have not yet been identified.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 12323F, Tactical Warning/Attack Assessment (TW/AA) Interface Network

A. Project Description:

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable

(2) (U) FY 1985 Program: Not Applicable

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: This program is an FY 1986 new start. Studies, analysis, and feasibility demonstrations will be performed to permit development of the SCIS concept. Efforts to develop preliminary performance specifications will be initiated. The procurement approach will be developed.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: This is an FY 1986 new start. A detailed milestone schedule is not yet developed.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12325F
DOD Mission Area: #122 - Strategic Air Defense

Title: Joint Surveillance System
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		762	1,802	3,069	2,997	Continuing	N/A
968H	Joint Surveillance System	762	749	0	0	0	46,493
2976	Atmospheric Tactical Warning Connectivity	0	0	2,000	1,960	Continuing	N/A
2996	FAA-USAF Minimally Attended Radars	0	1,053	1,069	1,037	5,298	8,457

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Joint Surveillance System (JSS) provides command and control of air defense forces for peacetime air surveillance and airspace sovereignty and replaces the Semi-Automatic Ground Environment (SAGE), Back-up Interceptor Control (BUIC), and manual air defense systems. The objective of this program is large cost avoidance in radar operation and operation center support through the elimination of redundancy in the civilian and military radar nets, and replacement of the SAGE/BUIC systems which were expensive to operate and maintain. The system uses radar data from a single joint-use net of Federal Aviation Administration (FAA) and military radars in the Continental United States (CONUS), Alaska and Hawaii to input to FAA Air Route Traffic Control Centers and six new Air Force Region Operations Control Centers (ROCCs). Two additional ROCCs were procured by Canada through this program via foreign military sales. The Atmospheric Tactical Warning Connectivity (ATWC) program is an FY 1986 new start to integrate data from the CONUS Over-the-Horizon Backscatter (OTH-B) Radar System, North Warning System (NWS) (Improved Distant Early Warning Line), and the E-3 Airborne Warning and Control System (AWACS) into the JSS ROCCs. An E-3A interface exists today that allows the E-3A data to be fully integrated into the JSS data and JSS data to be transmitted to the E-3A. OTH-B and NWS data must be integrated into the ROCCs to allow North American Aerospace Defense Command (NORAD) Region Commanders to direct air space control operations and forward selected radar tracking information to NORAD for incorporation into their Raid Recognition Algorithm. The FAA-USAF Minimally Attended Radar project will replace existing obsolescent JSS search, beacon and height finder radars with modern solid-state, three dimensional (3-D) minimally attended radars to improve mission performance and reduce operations and maintenance costs. The Air Force has a continuing need for target altitude (height) data to accomplish the air sovereignty mission. The FAA currently maintains the 31 USAF height finder radars in the JSS. Entering a joint program with the FAA allows the Air Force to upgrade radar performance and procure radars with integral height finding capability to meet joint requirements and also avoid the future need to buy new separate height finder radars. The new 3-D radars will be incorporated into the National Airspace System. The FAA will assume ownership and maintenance responsibility which results in a cost avoidance to the Air Force of about $55 million a year. If the Air Force did not participate

with the Federal Aviation Administration (FAA) in this program, the Air Force would have to assume maintenance responsibility for the height finder radars and eventually replace them with no long term cost avoidance.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	762	1,802	1,069		3,154	51,769
Other Procurement	2,250	22,088	37,952		155,161	362,328

RDT&E funds were added starting in FY 1986 for the Atmospheric Tactical Warning Connectivity Program. FY 1985 and FY 1986 Other Procurement funds show a decrease because replenishment spares funds were erroneously included in the FY 1985 Descriptive Summary. FY 86 Other Procurement funds were also decreased and FY 87 increased because procurement of two radars for the FAA-USAF Minimally Attended Radar project was delayed one year.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Other Procurement						
Funds	333	18,895	20,398	75,877	89,982	348,425
Quantities	0	2	5	9	10	
Military Construction						
Funds	0	0	0	1,775	5,154	6,929

5. (U) RELATED ACTIVITIES: JSS replaced the Semi-Automatic Ground Environment/Back-up Interceptor Control (SAGE/BUIC) systems. The SAGE/BUIC systems were phased out after JSS became operational in 1983-1984. JSS Region Operations Control Centers (ROCCs) will receive surveillance data from the CONUS Over-the-Horizon Backscatter (OTH-B) radar (PE 12417F) and the North Warning System (NWS) (PE 12412F) (DEW Line Improvement Program) when the NWS becomes operational. The JSS system includes Alaskan Air Command surveillance radars modernized by SEEK IGLOO (Project 2433, PE 12411F). JSS ROCCs must interface with the E-3 Airborne Warning and Control System (AWACS) (PE 27417F) to effectively transition command and control, if necessary, during wartime. JSS will provide command and control of air defense forces as the tactical situation dictates. The E-3A, as the more survivable element of air defense, will provide command and control during crisis and wartime. Coordination is obtained from FAA on radar sensor portions of the program. Close coordination is maintained with Canada through Canadian personnel assigned to the JSS Program Office and to the ROCC Software Support Facility at Tyndall AFB, FL. A joint FAA-USAF program office will be established at FAA headquarters to manage the FAA-USAF Minimally Attended Radar program. The FAA-USAF joint program office will coordinate with the Air Force Logistics Command MARK XII manager and the MARK XV Combat Identification System program office at Aeronautical Systems

Division for IFF interface requirements for the new 3-D radar.

6. (U) WORK PERFORMED BY: Program management is provided by the Electronic Systems Division of Air Force Systems Command, Hanscom AFB, MA. The prime contractor for the JSS Region Operations Control Centers (ROCCs) is Hughes Aircraft Corporation, Fullerton, CA. Engineering support is provided by Input/Output Computer Sciences, Waltham, MA; Logicon Incorporated, Lexington, MA; MITRE Corporation, Bedford, MA; and Support Systems Associates Inc., Burlington, MA. Competitive procurement of the new JSS radars will be accomplished by a joint FAA-USAF program office located at FAA headquarters. The FAA shall be the lead procuring agency. MITRE is supporting FAA specification preparation efforts. A contractor for the Atmospheric Tactical Warning Connectivity (ATWC) program will be selected in FY 1986.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2976, Atmospheric Tactical Warning Connectivity. This project is an FY 1986 new start. This project will develop modifications to the JSS ROCC so that data from the Continental U.S. (CONUS) Over-the-Horizon Backscatter Radar, North Warning System, SEEK IGLOO, and E-3A Airborne Warning and Control System (AWACS) is fully integrated. This will allow aircraft track data from these systems to be displayed within the ROCC for battle management purposes and allow composite track data to be sent to the NORAD Cheyenne Mountain Complex. The ROCC will also be modified to make possible transmission of larger volumes of track data between the ROCC and the E-3A to aid the E-3A in search and, when required, battle management. In the FY 1986 RDT&E effort, alternative approaches to integrate and display the required data in the ROCC will be analyzed and one selected for development. Hardware and software modifications to the ROCC will be defined. The studies will be performed by competitively selected contractors familiar with the JSS ROCC architecture. The connectivity alternatives study will begin in January 1986. An approach will be selected in November 1986.

B. (U) Project: 2996, FAA-USAF Minimally Attended Radars. The FAA-USAF Minimally Attended Radar (MAR) program replaces existing FAA-USAF search, beacon, and height finder radars in the JSS with state-of-the-art solid-state three dimensional (3-D) minimally attended radars. The FAA National Airspace System Plan (NASP), April 1983, proposed an extensive modernization of the air traffic control system. Two specific objectives of the plan are: implementation of a solid-state radar replacement program and implementation of a remote maintenance monitoring program. The plan addresses replacement of 44 existing JSS search, beacon, and height-finder radars and three radars outside the CONUS with a 3-D type radar. One additional radar will be procured for the FAA training center. Current JSS radar equipment is vacuum tube vintage, logistically difficult to support, and requires manpower-intensive maintenance. The procurement cost will be shared equally between the Air Force and FAA. Each buys 24 radar systems. Once installation is complete the radar sites will be turned over to the FAA as part of the National Airspace System. FAA will accomplish maintenance and the Air Force will continue to receive data for use by the JSS. A reduction of over 1000 Air Force manpower spaces and cost avoidance to the Air Force of about $35 million a year will be realized after program completion. Interface meetings with the FAA continued in FY 1984 to define management and cost sharing responsibilities. Facility and site surveys continued in FY 1984. Definition of radar operational requirements was begun. Radar specification and Request for Proposal (RFP) preparation began. A joint procurement agreement describing management responsi-

bilities and cost sharing was jointly signed by the FAA and USAF in FY 1985. Site surveys will be completed in FY 1985. The RFP will be released in March 1985. Contract award is planned for January 1986. FY 1986 RDT&E funds will be used to support source selection activities and by the program office to subsequently manage the contractor. The first system will be delivered by September 1988.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12411F — Title: Surveillance Radar Stations/Sites
DOD Mission Area: #122 - Strategic Air Defense — Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		5,256	3,514	20,215	43,002	219,694	331,266
2433	SEEK IGLOO	1,087	914	0	0	0	41,186
2980	North Atlantic Defense System	2,119	2,600	5,570	1,925	15,784	27,998
3137	POTEEN	2,050	0	9,547	40,077	197,910	249,984
3159	Caribbean Basin Radar Network	0	0	5,098	1,000	6,000	12,098

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element funds strategic air defense improvements. The SEEK IGLOO project will enhance the surveillance and air space control capability of Alaskan Air Command (AAC) and reduce support costs through modernization of existing AAC surveillance radars. SEEK IGLOO developed a minimally attended three dimensional (3-D) radar, using current technology, to replace the existing separate surveillance and height finder radars. The new radar, the General Electric AN/FPS-117, has integral height finding capability, improved performance in the presence of clutter and will be maintained by significantly fewer personnel than are required in existing systems. The North Atlantic Defense System (NADS) funds improvements to command, control, and communication (C^3) and surveillance equipment in the North Atlantic required to correct air defense deficiencies in Iceland [ ] Existing C^3 and surveillance equipment will be ineffective if challenged in wartime. The current Iceland Air Defense and Early Warning System is manually operated, antiquated and deficient in radar coverage. The lack of automation and inadequate C^3 facilities precludes timely distribution and exchange of vital air defense information received from radar sites, airborne early warning systems, maritime forces, and adjacent NATO air defense ground environment systems. [ ] With existing deficiencies, Soviet aircraft and surface and subsurface vessels can exploit the poor C^3 capability and the gaps in radar coverage to attack critical targets in Iceland without warning [ ] This area is considered a linchpin of the Northern flank and the key to reinforcement of the entire NATO theatre. [ ] effort to determine the technical feasibility of a [ ] for air and sea surveillance of the Greenland-Iceland-United Kingdom gap and the Norwegian Sea. [ ] The US purpose for

an[ ]is to provide early warning of an air attack on Iceland and long-range wide area surveillance of the North Atlantic Sea Lines of Communication (SLOCs) to satisfy Commander-in-Chief Atlantic Command (CINCLANT) requirements. Early warning of a potential air attack on the North American continent will also be provided. [

will complement ground-based microwave radars and Airborne Early Warning Aircraft operating in the North Atlantic. Data from this system will be forwarded to command centers on Iceland and to North American Aerospace Defense Command (NORAD). The Caribbean Basin Radar Network (CBRN) project will provide [

] The CBRN project is an FY 1986 new start.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	5,256	11,890	7,870		9,697	74,298
Other Procurement	19,414	13,916	24,137		71,023	222,783

FY 1985 RDT&E was reduced $8.376 million by Congress. RDT&E funds were added in FY 1986 through FY 1990 for the POTEEN and Caribbean Basin Radar Network (CBRN) projects. The POTEEN project consists of three phases. In Phases I and II feasibility experiments are conducted to determine if[ ]will satisfy mission requirements in a cost effective manner. Development and installation are conducted under Phase III. Funds were added for Phase III and an expanded Phase II. Phase II will provide limited operational data until Phase III is complete in[ ] Other Procurement funds were also added in FY 1987 through FY 1990 for the CBRN project. Funds for the new CBRN project will provide [ ]

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds (Total)	9,127	10,534	28,762	44,672	104,894	292,282
2433 SEEK IGLOO	9,127	0	0	0	0	103,420
2980 NADS	0	10,534	24,362	29,787	33,523	98,206
3159 CBRN	0	0	4,400	14,885	71,371	90,656
Quantities						
3-D Radars, Project 2433	1	0	0	0	0	
AWACS Data Link, Project 2980	0	1	0	0	0	
C^3 Equipment, Project 2980	0	1	0	0	0	
Command Center, Project 2980	0	0	1	0	0	
Military Construction:						
Funds	0	0	0	21,567	39,054	60,621

5. RELATED ACTIVITIES: The study of SEEK IGLOO alternatives and definition of technical requirements for a minimally attended radar were performed under Program Element (PE) 12325F, Joint Surveillance System (JSS). The new radar, the AN/FPS-117, was designed to interface with the JSS equipment. One SEEK IGLOO radar has been diverted to satisfy an urgent requirement to replace an aged radar in Berlin, Germany. Reimbursement to replace the Alaskan asset was provided by the Federal Republic of Germany. The AN/FPS-117 Minimally Attended Radar (MAR) will also be used to enhance performance and logistics supportability of the Distant Early Warning (DEW) Line. Implementation of DEW Line improvements will be accomplished under PE 12412F, DEW Radar Stations, Project 2710, titled NORTH WARNING. AN/FPS-117 MARs may also be used to modernize the JSS and to improve surveillance capabilities of the North Atlantic Defense System (NADS). NADS is planned as a conjunctively funded NATO infrastructure project. If deployed, will feed data to the command center built under NADS. The

6. (U) WORK PERFORMED BY: Efforts are managed by the Electronic Systems Division, Hanscom AFB, MA. Technical support is provided by MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. POTEEN experimental efforts are being conducted by SRI International, Menlo Park, CA. AN/FPS-117 radar production contracts have been awarded to General Electric. No contractors have been selected for the NADS or Caribbean Radar System projects.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2980, North Atlantic Defense System. The purpose of the North Atlantic Defense System (NADS) program is to correct serious air defense deficiencies in Iceland and provide for surveillance of critical Sea Lines of Communication (SLOCs). The NADS project consists of four subprojects: the Iceland Command and Control Enhancement (ICCE) project; the Command Center Automation (CCA) project; the Interim Automated Air Defense System (IAADS) project; and the NATO NADS project. The ICCE project will develop, procure and deploy an E-3 digital data link for Iceland. The CCA project will provide air defense Command, Control, and Communications (C^3) equipment for the new joint-service Combined Operations Center (COC) that supports all theater operations. The COC is a separate NATO Infrastructure project managed by the Navy. The COC will be a battle staff facility for COMICEDEFOR. The COC also houses the Navy Anti-Submarine Warfare Operations Center (ASWOC). The IAADS project will acquire a Region Operations Control Center (ROCC)-type air defense command and control capability, will deploy an additional two FPS-93 search radars in northern Iceland, will fully automate radar data transmission from all four FPS-93s, and will provide necessary communications. The IAADS is an interim system and will be eventually replaced by the fully capable NATO acquired NADS. The NATO NADS is planned as a conjunctively funded NATO Infrastructure program for which the US will serve as host nation. The NATO NADS project will acquire and deploy a new Command and Control Center (CCC), five new three dimensional (3-D) radars on Iceland, and additional 3-D radars to be located in other areas surrounding Iceland. It will also upgrade the entire communications system. The CCC will serve as the facility for conducting all air operations and will be a separate facility from the COC. The study defining NADS origins of information, communications alternatives, automated data processing alternatives, control and reporting system alternatives, and survivability was completed and submitted to NATO in May 84. Development of documentation to support FY 1985 equipment procurement was begun in FY 1984 for both the Iceland Command and Control Enhancement effort and the Command Center Automation effort. Radar site surveys were accomplished. Preparation of a NATO Type B Cost Estimate for the entire project was begun in FY 1984. ICCE and CCA equipment will be procured in FY 1985. FY 1985 efforts will also include preparation of a request for proposal (RFP) and proposal evaluation for an interim ROCC-type control and reporting center (CRC) on Iceland. The Type B cost estimate for the NATO program will be completed. ICCE Initial Operational Capability (IOC) will occur in FY 1985. ICCE and CCA software development will begin. In FY 1986, Invitation for Bid (IFB) preparation will be done for the NATO program. Software development for ICCE and CCA will continue. Contract award for the interim automated air defense system will occur in FY 1986. Full Operational Capability (FOC) for ICCE, CCA, and the interim automated air defense system will occur by mid FY 1988. Contract award for the NATO program will occur in FY 1987 with IOC planned for FY 1989 and FOC for FY 1992.

B. Project: 3137, POTEEN. [ ] Funds shown in this document are the US share only. [ ] and covering the Greenland-Iceland-United Kingdom gap and the Norwegian Sea would provide sufficient warning time to allow air defense forces to react to a Soviet bomber, cruise missile, or surface ship attack. Unfortunately, ionospheric conditions in far northern latitudes make [ ] operation difficult. POTEEN is planned as a three phase program. First, we will determine if an [ ] can be operated effectively, then develop the unique specifications for operation at this latitude, and finally [ ]

[ ] Development of unique specifications for this radar is necessary since neither the [

]can satisfy the mission requirements for this radar without modification. These radars were designed for different missions and operation at less northerly latitudes. The [ ]has no requirement to detect surface ships and hence has no capability to detect them. The [ ]has no requirement to operate in far northern latitudes and hence may not have the power to propagate radar signals through the absorptive ionospheric layers prevalent in the north. An additional factor in the [

] The acquisition strategy will be to compete the contract among teams of [ ]contractors and let cost determine whether modification of the [ ]is the better solution to the problem. RDT&E funds are requested because the amount of modification to [ ]is not appropriate for funding with Other Procurement funds. In FY 84 a low power ionospheric sounder (signal generator) was installed [ ] to assess radar signal transmission characteristics in northern latitudes. Data was collected from this sounder and was analyzed by radar experts from the US [ ] A preliminary Concept of Operations was developed in coordination with Tactical Air Command (TAC) and Air Forces Atlantic (AFLANT) to guide utility assessment of [ ] A [ ]radar feasibility study team was organized. Starting in FY 85, [ ] The feasibility study effort will be completed using reprogrammed FY 84 funds. A draft System Operational Concep (SOC) will be developed. The Memorandum of Understanding (MOU) for future phases will also be discussed [ ] The FY 1986 RDT&E program will initiate acquisition of the high power ionospheric sounder (Phase II) via a competitive contract award process. This equipment will be [ ]and one year of data collection begun in FY 87. Phase II data collection will be performed during FY 1987. This data will be used to make a final decision on whether to proceed with deployment. If a decision is made to [ ]the Phase II data will be used to refine the system specifications as necessary to meet requirements. The request for proposal (RFP) for the [ ]will be released and proposals evaluated during FY 1988 and 89. Preparation of the competitive bid package for the [ ]will begin, to include drafting of system specifications. [The Phase III MOU will also be developed and signed [ ] Development, production, installation and test of the [ ]will be conducted from [ ] The cost estimates for the program fall under Category IV (Planning) for Phase II and are based on contractor inputs received in July 1984.

C. Project: 3159, Caribbean Basin Radar Network. The Air Force Caribbean Basin Radar Network (CBRN) project will provide [

] The CBRN project is an FY 1986 RDT&E and procurement new start. A system definition, specification and Request for Proposal will be prepared. Site surveys will be done. A Concept of Operations will be written.

[ ] The Air Force, Army and Navy will each fund one system. The Army has the lead [ ] Three more [will be procured in FY 87. Again, the Air Force, Navy and Army will each fund one system. A contract will also be awarded in FY 1987 for the [ ] Cost estimates are budgetary.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12412F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Distant Early Warning (DEW) Radar Stations
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		26,822	46,000	40,914	14,650	13,952	148,053
2710	North Warning	26,822	46,000	40,914	14,650	13,952	148,053

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This PE supports the operation of 31 existing DEW Line radar stations and funds the North Warning System (NWS) (DEW Line improvement program). The DEW Line is required to provide tactical warning of bomber or cruise missile attack against the North American Continent through a radar line extending from Alaska to Greenland. The warning provides the National Command Authorities with time for decision making and survival actions, permits the launch of strategic retaliatory and command and control aircraft for survival and alerts air defense fighters to intercept attacking aircraft. The present DEW Line can be underflown by threat bombers because of numerous gaps at low altitude and marginal radar performance. Because of its age (1957 initial deployment), the existing DEW Line system is increasingly difficult and costly to operate and maintain. NWS program objectives are to eliminate low altitude coverage gaps and improve radar performance while reducing operations and maintenance costs. A combination of long-range minimally attended radars and short-range unattended gapfiller radars will be deployed. The North Warning System will be capable of detecting modern Soviet threat aircraft and cruise missiles[

NWS investment costs will be amortized by reduction in operations and support costs attributable to NWS and phase out of U.S. contribution to the operation of the CADIN-Pinetree radar system in the interior of Canada.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	24,537	63,094	6,814		10,900	113,345
Other Procurement	90,094	61,336	183,517		172,829	507,776

The FY 1985 RDT&E decrease reflects the FY 1985 Congressional reduction of $16,094 thousand. FY 1986 RDT&E and Total Estimated Cost were increased to reflect funds required to execute the program based on the Full Scale Development (FSD) contract awarded 10 August 1984. FY 1985 Other Procurement was decreased by $10 million in the amended FY 1985 President's Budget. FY 1986 Other Procurement was reduced because short range radar procurement has been delayed until FY 1988. Other Procurement Total Estimated Cost reflects Not-To-Exceed (NTE) proposals submitted with proposals for the FSD program.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	89,094	51,336	11,335	0	475,319	627,084
Quantity Long Range Radar	10	3	0	0	0	13
Quantity Short Range Radar	0	0	0	0	37	37

5. (U) RELATED ACTIVITIES: Design study contracts for the unattended short-range radar (part of the Unattended/Minimally Attended Radar Study) and a totally unattended site were funded in PE 63101F (Preliminary Design and Development). The AN/FPS-117 minimally attended long-range radar developed under PE 12411F (Surveillance Radar Stations/Sites, Project SEEK IGLOO) is planned for use in the North Warning System DEW Line improvement program. The study effort and procurement planning related to application of the AN/FPS-117 for DEW Line improvement was performed under PE 12411F. Radar coverage around North America will be contiguous with northern coverage provided by the North Warning System (NWS) and east, west and southern coverage provided by Over-the-Horizon Backscatter (OTH-B) radars in PE 12417F. Surveillance data from the North Warning System will be transmitted to northern Region Operations Control Centers developed under PE 12325F, Joint Surveillance System. The NWS program is a key element of air defense upgrades detailed in the DOD North American Air Defense Master Plan and identified as part of President Reagan's Strategic Modernization Plan. The current DEW Line is an integral part of North American Aerospace Defense Command (NORAD) surveillance and warning assets and operation of the system is supported by a U.S.-Canadian Government-to-Government Agreement. The Department of Defense is conducting cost and responsibility sharing discussions with Canada on North American air defense modernization programs. The U.S. has proposed that Canada be responsible for NWS communications equipment procurement and facilities construction in Canada. Canada has agreed in principle to cost sharing, but there is not yet a formal agreement.

6. (U) WORK PERFORMED BY: This effort is managed by the Electronic Systems Division, Hanscom AFB, MA. MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; Analytical Systems Engineering Corporation, Burlington, MA; Earth Technology Corporation, Seattle, WA; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD are providing technical support. AN/FPS-117 long-range radars will be procured from General Electric Company, Syracuse, NY and provided as Government Furnished Equipment to the systems contractor. Sperry Corporation, Great Neck, NY was selected as the systems contractor who will be responsible for the full scale development of the short-range unattended gapfiller radar station, overall system engineering, and development of a communications architecture. The Department of Energy (DOE) and Atomic Energy of Canada, Limited (AECL) are developing an alternative power generation system for the short range radar station.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2710, North Warning

A. Project Description: North Warning System (NWS) will improve the operational capability of the existing DEW Line by eliminating low altitude coverage gaps, improving radar performance and reducing operations and maintenance costs by approximately half. Present Soviet bombers can fly undetected through gaps in the DEW Line. The improved DEW Line, NWS, will be capable of detecting improved threat bombers such as BLACKJACK and cruise missiles [ ] An NWS pre-planned product improvement will provide additional capability, [ ] In this project, a communications architecture and logistics support concept will be developed. Thirteen (13) AN/FPS-117 long-range radars will be procured. An unattended short-range gapfiller radar station will be developed and tested, and approximately 39 deployed. Communications upgrades to support the new NWS radar network and facilities construction are also part of the improvement program.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Radar coverage and terrain analyses were conducted. Intrasystem electromagnetic compatibility analyses began. Studies were conducted on communications requirements. Environmental assessments were conducted. A power technology assessment was completed. A Full Scale Development (FSD) contract was awarded for development of the short-range radar station and development of the overall system architecture.

(2) (U) FY 1985 Program: Short-range radar (SRR) station design and development will continue. Short-range radar station Preliminary Design Reviews will be held. The first of several Critical Design Reviews (CDR) of the SRR station will be conducted. Fabrication of two (2) prototype short range radars will begin. Site surveys will be accomplished. A contract was awarded for procurement of AN/FPS-117 long-range radars which will be provided to the systems contractor as Government Furnished Equipment (GFE).

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: All SRR station Critical Design Reviews and the SRR Final Design Review will be conducted. Prototype SRR station facility fabrication will begin. Fabrication of two prototype short-range radars will continue. SRR station software will be coded, compiled and debugged. In-plant component and subassembly testing will begin. Communications equipment will be procured for the two long-range radar sites in Alaska. FY 1986 RDT&E cost estimate and total program RDT&E cost estimate are mature estimates based on an initial Independent Cost Estimate and a Fixed Price Incentive Firm contract for the Full Scale Development program.

(4) (U) Program to Completion: Prototype SRR facility construction will be completed in FY 1987. Prototype SRR fabrication will be completed in FY 1987. DT&E testing of the SRR will be completed in FY 1988. Development of the SRR station and SRR station Initial Operational Test and Evaluation (IOT&E) will be completed in FY 1988. Initial Operational Capability will be achieved in FY 1988. Procurement of SRRs will begin in FY 1988 and will be completed

in FY 1990 leading to an FY 1992 Full Operational Capability.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Full Scale Development (FSD) Request for Proposal (RFP) Released		May 1983
(2)	(U)	FSD Proposals Received		Jul 1983
(3)	(U)	Revised RFP Released		Jan 1984
(4)	(U)	Revised Proposals Received		Feb 1984
(5)	(U)	FSD Contract Award	*(Apr 1984)	Aug 1984
(6)	(U)	Production Contract Award for FPS-117 Radars	*(Mar 1984/Dec 1984)	Feb 1985/Apr 1985
(7)	(U)	Conclude Negotiations with Canada		Feb 1985
(8)	(U)	Short Range Radar (SRR) Development Test and Evaluation (DT&E) Completed		Mar 1988
(9)	(U)	SRR Initial Operational Test and Evaluation (IOT&E) Completed		May 1988
(10)	(U)	Initial Operational Capability	*(Aug 1987)	Aug 1988
(11)	(U)	Production Contract Award for Short-Range Radar		May 1988/Dec 1988/Dec 1989
(12)	(U)	Full Operational Capability	*(Aug 1990)	Aug 1992

* Date presented in FY 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(5) (U) FSD Contract Award slipped four months due to extended source selection activity.

(6) (U) Production Contract Award for FPS-117 Radars slipped eleven months pending a complete internal Department of Defense review of the planned North Warning System (NWS) program and extended negotiation with General Electric.

(10) (U) Initial Operational Capability has slipped one year due to extended source selection activities and a longer than planned (42 vs 36 month) development program.

(11) (U) Full Operational Capability has slipped two years due to the Full Scale Development Program slip and to reduce program concurrency.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12417F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: CONUS Over-the-Horizon Radar
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		96,875	60,890	67,457	36,393	108,410	370,025

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops an Over-the-Horizon Backscatter (OTH-B) radar to satisfy requirements for tactical early warning of an attack on North America by bombers and air-to-surface missiles. Development of the OTH-B radar provides long-range wide area surveillance at all altitudes. It will detect and track airborne vehicles at ranges between approximately 500 and 1800 nautical miles from the radar. OTH-B increases warning time for survival of retaliatory forces and provides decision time for the National Command Authorities consistent with ballistic missile warning requirements. It also significantly enhances redeployment options of available defense forces. The OTH-B will provide surveillance coverage of the east, west, and southern approaches to North America. Surveillance coverage in the north between the East and West Coast Systems will be provided by the North Warning System (PE 12412F). This program is budgeted at the most likely cost and does not differ materially from known contractor estimates.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	96,875	60,904	67,991		Continuing	N/A
Other Procurement	100,080	235,380	258,194		308,491	902,145

Procurement dollars differ from last year for two reasons. First, the acquisition schedule of the west coast system and planned south-looking system has been slipped as a result of Congressional actions. This will increase the unit

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cost. Second, four additional 60 degree sectors have been added to the planned buy. Two of these sectors will be located in Alaska for Aleutian Island air surveillance and two will be colocated with the south-looking sectors. These sectors will provide surveillance of the Atlantic and Pacific Oceans interior to the coverage of the East and West Coast Radar Systems.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	98,720	145,380	263,840	274,482	794,533	1,576,955
Quantities (60 Degree Sectors)	1	1	2	2	5	11
Military Construction:						
Funds	10,100	0	12,400	11,373	213,358	247,231

5. (U) RELATED ACTIVITIES: The CONUS Over-the-Horizon Backscatter (OTH-B) radar system is being developed to provide all-altitude tactical early warning in support of our strategic air defense mission. The OTH-B will be compatible with related programs such as the North Warning System Radars (PE 12412F), the Joint Surveillance System (PE 12325F), and air defense interceptor forces. The OTH-B system will send track information to the Regional Operations Control Centers of the Joint Surveillance System and to the NORAD Cheyenne Mountain Complex. Communications will be provided under OTH Radar Systems Comm (PE 12444F). Related OTH radar developments by the Office of Naval Research and the Naval Electronic Systems Command are monitored by the Air Force.

6. (U) WORK PERFORMED BY: The development of the OTH-B radar system and supporting OTH technical efforts are managed by the Air Force Electronic Systems Division, Hanscom AFB, MA. The radar prime contractor is the General Electric Co., Syracuse, NY. Major subcontractors include Continental Electronics, Dallas, TX, for the transmitter subsystem and TRW, Redondo Beach, CA, for the software development. Continuing OTH technical efforts, analysis, engineering studies and support are provided by: Rome Air Development Center, Griffiss AFB, NY; SRI International, Remote Measurement Laboratory, Menlo Park, CA; Naval Research Laboratory, Washington, D.C.; MITRE Corporation Bedford, MA; and the Air Force Geophysics Laboratory, Hanscom AFB, MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

Program Element: #12417F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: CONUS Over-the-Horizon
Budget Activity: #3 - Strategic Programs

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12417F, CONUS Over-the-Horizon Radar

A. (U) Project Description: This project converts the Experimental Radar System (developed by PE 63703F) into the initial 60 degree azimuthal coverage sector of the operational radar system. Other Procurement funds budgeted for the project will allow acquisition of a 180 degree azimuthal coverage system on each coast of North America, a 120 degree coverage system in the Central U.S. for southern area surveillance, a 120 degree coverage system in Alaska for Aleutian Island air defense, and an two 60 degree coverage sectors located in the Central U.S. for surveillance of ocean areas as a complement to the East and West Coast Systems. A Pre-Planned Product Improvement Program (P^3I) will also be conducted.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Upgrade of the east coast experimental radar system to a fully operational 60 degree azimuthal coverage sector was continued. The Transmitter for this East Coast System is near Bingham, ME, the Receiver near Columbia Falls, ME and the Operations Center at Bangor ANGB, ME. The transmitter acceptance testing was completed by the subcontractor and the unit was delivered to the prime contractor. Fabrication of receiver components was completed and testing begun. The operational computer and display equipment for the operations center was delivered to the prime contractor. The operations center building was completed. All software design was completed. Software modules were coded and tested. Design of the integrated 180 degree coverage radar system was completed. Sites for the Transmitter, Receiver and Operations Center for the west coast radar were selected and announced. The Transmitter for the West Coast System will be near Christmas Valley, OR, the Receiver near Alturas, CA and the Operations Center will be at Mountain Home AFB, ID. Action to withdraw the land for these sites from the Bureau of Land Management and U.S. Forest Service was begun. A contract for the procurement of the second sector of the east coast radar was begun. The site preparation for this second sector was completed.

(2) (U) FY 1985 Program: Development will continue on the upgrade of the experimental radar system to an operational configuration. The software and hardware will complete component testing and be installed at the site in Maine. Development Test and Evaluation (DT&E) of the initial operating 60 degree sector will commence. Special tests using this initial sector and other existing OTH radars will be conducted to refine our understanding of OTH detection and tracking of Sea Launched Cruise Missiles (SLCM). Surveys are planned of candidate locations in the central U.S. for the south-looking radar sectors and the sectors for surveillance of ocean areas (to complement the East and West Coast Radar Systems). A procurement contract for the final east coast sector will be signed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The RDT&E funds will be used to complete the DT&E of the initial operating sector, including support for TAC, SAC, MAC, and AFSC aircraft used as targets for

the OTH-B radar. Radar system support items (intrusion detection devices, back-up power connects, etc.) will be acquired and installed. Testing of the sector to determine SLCM capability will continue, and include dedicated drone and cruise missile flights. The Environmental Impact Statement for candidate central U.S. sites will be prepared. Procurement of the West Coast Radar System will begin with acquisition of the first two sectors using procurement funds. The cost estimates for this work are based on the existing contract which will contain FY 1986 work, contractor estimates, an Independent Cost Analysis (ICA) for items not on contract, and AF planning factors for the flight hours supporting DT&E and SLCM testing. The estimates are thus mature. The ICA was completed in August 1983. All RDT&E items not currently on contract will be awarded on a sole source basis.

(4) Program to Completion: In [ ] the initial sector will be integrated to the second and third sectors to form the complete East Coast Radar System. This system will undergo Operational Test and Evaluation (OT&E) and the Inital Operational Capability (IOC) will be declared. Procurement of the West Coast Radar System will be completed in FY 1987. The Central US Radar system will be acquired in FY 1987, 1988 and 1989. The Alaskan Radar system will be procured in FY 1989 and 1990. A Pre-Planned Product Improvement (P^3I) RDT&E program will begin in FY 1988. This program will develop and test improvements and modifications needed to keep the OTH-B radar responsive to the evolving threat.

C. Major Milestones:

		Milestones	Dates
(1)	(U)	System Definition Complete	November 1973
(2)	(U)	Prototype Contract Award	March 1975
(3)	(U)	Initiate Program Restructuring	December 1976
(4)	(U)	Conclude Technical Feasibility Test	February 1981
(5)	(U)	Conclude IOT&E	June 1981
(6)	(U)	AFSARC Review	November 1981
(7)	(U)	Development Decision	January 1982
(8)	(U)	Development Contract Award	June 1982
(9)		Initial Operational Capability (IOC) - East and West	
(10)		Central U.S. Sectors (FOC)	
(11)			

*Date presented in FY 1985 Descriptive Summary

Program Element: #12417F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: CONUS Over-the-Horizon Radar
Budget Activity: #3 - Strategic Programs

(U) EXPLANATION OF MILESTONE CHANGES

(9) IOC of West Coast System delayed by Congressional deletion of first west coast sector from FY 1985 Authorization Bill.

(10) IOC of Central U.S. System delayed by the slip in the acquisition schedule for the West Coast System and by the increased scope of work (four sectors instead of two.)

Budget Activity: 3, Strategic Programs
Program Element: 12417F, CONUS Over-the-Horizon Radar System

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Initial Operating Sector (IOS) of the OTH-B Radar System is currently in full scale development. All design reviews are complete and initial units are in component testing. The equipment will be installed at the sites in FY 1985 and undergo six months of contractor testing prior to AF DT&E. AF DT&E will be performed using the IOS beginning in April 1986.

(U) The IOS is an upgrade to the earlier Experimental Radar System (ERS) which had a complete DT&E and Initial Operational Test and Evaluation (IOT&E) conducted by Air Force Systems Command (AFSC) and Air Force Operational Test and Evaluation Center (AFOTEC) personnel. These activities proved that the key system characteristics (listed in paragraph 3 below) could be satisfied by an operational system.

(U) The OTH-B program manager is Col A. L. Snyder, Electronic Systems Division (ESD), Hanscom AFB, MA. The development program prime contractor is General Electric (GE) Electronic Systems Division, Syracuse, New York. ESD is responsible for all DT&E. They will use the services of the following organizations to accomplish DT&E: MITRE Corp, GE, Stanford Research Institute International, Rome Air Development Center, AF Geophysics Laboratory, Naval Research Laboratory and the Federal Aviation Administration. The software will be independently verified and validated by Scientific Systems Inc and Calspan Corp. The Tactical Air Command (TAC), Strategic Air Command (SAC), Military Airlift Command (MAC), and AFSC will supply aircraft for the operational tests and TAC will supply the radar operators. GE will maintain the East Coast Radar System (ERCS) during DT&E.

2. (U) Operational Test and Evaluation (OT&E): The AFOTEC conducted a limited IOT&E from 1 March through 4 June 1981 on the ERS. The IOT&E was conducted primarily at the ERS combined receiver and operations site near Columbia Falls, Maine. Some testing was conducted at the transmitter site near Moscow, Maine.

(U) The results of the limited IOT&E on the ERS are documented in the OTH-B ERS IOT&E Final Report, July 1981 (Secret). This report details the operational deficiencies noted during testing. The report recommended the operational concept for the OTH-B radar be changed from single aircraft detection to raid detection probability.

(U) AFOTEC will conduct an OT&E on the operational ECRS from 1 June through 30 September 1987. The ECRS consists of the IOS plus the first two production sectors, providing integrated 180 degree azimuthal coverage of the eastern approaches to North America. The purpose of this OT&E will be to evaluate the operational effectiveness and suitability of the OTH-B, and to ensure that system program office solutions to AFOTEC-identified problems in the ERS have been incorporated into the ECRS.

Budget Activity: 3, Strategic Programs
Program Element: 12417F, CONUS Over-the-Horizon Radar System

(U) The operational issues to be examined during the OT&E are:

a. (U) Raid recognition. The OTH-B must provide sufficient information to North American Aerospace Defense Command (NORAD) for their use with other data to recognize a raid on North America.

b. (U) Effective barrier. The East Coast Radar System (ECRS) erects an electromagnetic barrier at all atmospheric altitudes that is used to detect and track aircraft. This barrier must have sufficient depth and contiguity to support tactical early warning.

c. (U) Northern barrier linkage. The ECRS barrier must overlap the coverage provided by North Warning System.

d. (U) Interoperability. Information from the ECRS will be provided to the Region Operational Control Centers (ROCCs) and the NORAD Cheyenne Mountain Complex (NCMC). The Oceanic Control Areas (OCAs) will provide air movement data to the ECRS. Because of these interfaces, the interoperability between the ECRS and these facilities is a vital operational issue.

e. (U) Maintainability. The ECRS must be maintainable in accordance with the TAC maintenance concept.

f. (U) Human factors. The design of the equipment, operations center, and consoles must be optimized for human performance.

g. (U) Operations training. The ECRS must be designed and constructed to allow individual and unit operations training as well as participation in NORAD exercises.

h. (U) Logistics supportability. The ECRS must be supportable by the existing organic structure.

i. (U) Availability. The ECRS must meet the required operational availability.

3. (U) Systems Characteristics:

Characteristic	Objective; Threshold	Demonstrated (Experimental Radar System)*
OPERATIONAL		
1. RAID DETECTION** PROBABILITY/% OF TIME	[ ]	[ ] based on a theoretical extrapolation of values demonstrated for single aircraft.
2. AVAILABILITY	[ ]	--

3. (U) MEAN TIME BETWEEN FAILURES (HRS)	40; 20	--

* This data was derived from one year of tests, under various seasonal/diurnal conditions, and at all ranges. Seasonal average data are based on Development Test and Evaluation (DT&E) results, other averages are based on Initial Operational Test and Evaluation (IOT&E) results.

** A raid consists of twenty or more aircraft or air-breathing missiles.

Characteristic	Objective; Threshold	Demonstrated (Experimental Radar System)
TECHNICAL		
1. (U) DETECTION/TRACKING RANGE (NM) CAPABILITY	500-1800; 600-1500	500-1800
2. ABSOLUTE ACCURACY (RMS) (NM)	[ ]	[ ]
3. SPEED RESOLUTION (KTS)	[ ]	[ ]

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks

No testing has taken place in the past 12 months.

T&E Activity (Next 12 Months)

Event	Planned Date		Remarks

No testing is scheduled to take place in the next 12 months.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12423F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Ballistic Missile Early Warning System (BMEWS)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		12,599	10,016	12,966	18,771	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Early Warning System (BMEWS) consists of three sites located at Thule, Greenland; Clear, Alaska; and Fylingdales, England. Its mission is to detect and provide warning of a ballistic missile attack on the United States, Canada, the United Kingdom, or Europe. The BMEWS was built in the late 1950s and early 1960s. At the time, the Soviet threat consisted of a relatively small number of single-warhead missiles; and our national nuclear strategy was one of massive retaliation. The system was originally designed to predict missile impact points by tracking the large, easy to detect, rocket booster and extrapolating the ballistic path of the single warhead. As the system has aged, portions of it have become increasingly difficult to support.

As a result, the system is being modernized with a radar upgrade and associated computer resources to ensure reliable performance and to better support the national nuclear retaliatory strategy of flexible response.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	10,699	10,016	9,574		11,136	51,687
Other Procurement	1,980	2,069	-0-		Continuing	N/A

(U) The differences between the funding levels depicted in the FY 1985 and FY 1986 Descriptive Summaries reflect the initiation of an upgrade to the Fylingdales BMEWS site. This effort will commence in FY 1986. The upgraded site will achieve operational capability in FY 1990.

Program Element: #12423F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Ballistic Missile Early Warning System (BMEWS)
Budget Activity: #3 - Strategic Programs

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	2,861	5,926	80,498	42,844	Continuing	N/A
Quantities	Not Applicable					

5. RELATED ACTIVITIES: BMEWS is part of the national system for Tactical Warning and Attack Assessment. It provides confirmation of initial launch detection information provided by the [ ] and complements the information provided by the Sea Launched Ballistic Missile Detection and Warning networ (PE 12432F) and the North American Aerospace Defense (NORAD) Command Space Detection and Tracking System (PE 12424F). BMEWS data is provided to the National Military Command Center, the Alternate National Military Command Center, the Strategic Air Command Command Center and other users via the NORAD Cheyenne Mountain Complex.

6. (U) WORK PERFORMED BY: The prime contractor for the Thule radar upgrade is Raytheon Corporation, Wayland, MA, with Control Data Corporation (CDC), Minneapolis, MN (computers), and TRW, Redondo Beach, CA (software) as subcontractors. The program is managed by Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA, in conjunction with the North American Aerospace Defense (NORAD) Command, Space Command, and Air Force Communications Command. General system engineering is being provided by the Mitre Corporation, Bedford, MA. The prime contractor for the Fylingdales upgrade is not yet determined.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12423F, Ballistic Missile Early Warning System (BMEWS)

A. Project Description: The BMEWS modernization program will assure continued reliable operation of our Intercontinental Ballistic Missile (ICBM) warning network by upgrading the radars and data processing equipment at the Thule and Fylingdales sites. These improvements will solve system support problems associated with obsolescing equipment and increase the system's capability to detect, track and provide accurate and timely warning of the [ ] At the Thule site the conventional detection and tracking radars are being replaced with a new dual-faced

Program Element: #12423F | Title: Ballistic Missile Early Warning System (BMEWS)
DOD Mission Area: #332- Strategic Surveillance and Warning | Budget Activity: #3 - Strategic Programs

phased array radar. Site data processing capability will be expanded and new software will be written to allow the radar to detect, track, and report on a much larger number of smaller, more closely spaced objects. The [problem will be solved; and the system missile count capability will be significantly improved. The upgrade will also improve the site's ability to [ ] This will greatly increase the system's tactical warning capability and also enable it to provide more accurate attack assessment information. The Thule radar upgrade will be completed late in 1986. A similar upgrade effort for a three-faced phased array radar will begin at the Fylingdales site in 1986 and will be completed in late 1989.

B. (U) Program Accomplishments And Future Efforts:

(1) (U) FY 1984 Accomplishments: Testing was completed and operational status achieved for new missile impact predictor (MIP) computers at all three BMEWS sites. Efforts on the Thule upgrade, including facility modification, continued on schedule. All program design reviews were completed and in-plant testing was initiated. Planning began for the upgrade to a phased array radar system at the Fylingdales site.

(2) (U) FY 1985 Program: The Thule upgrade effort will encompass in-plant testing for equipment and software, followed by on-site installation. Facility modification will be completed and system checkout begun. A solicitation will be released to industry for the Fylingdales upgrade.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Work will be completed on the Thule radar upgrade and on-site testing will commence in preparation for initial operational capability (IOC) early in FY 1987. Software development associated with the Fylingdales upgrade will begin, as well as test planning and overall system engineering. The new software will ensure maximum exploitation of the much greater target handling capacity of the new phased array radars. The estimated cost of the Thule upgrade is based on contract line items and negotiated options on the Thule radar upgrade contract signed on 29 July 1983. The planning estimate for the Fylingdales upgrade is based on program office experience gained in the closely-related Thule upgrade and the four site PAVE PAWS expansion program, and validated by a product division sufficiency review in December 1983.

(4) (U) Program to Completion: Upgrade of the Thule site will be completed and IOC achieved in FY 1987. Upgrade of the Fylingdales site will be completed in FY 1990. This is a continuing program; upgrade efforts will be implemented as necessary to accommodate Tactical Warning/Attack Assessment (TW/AA) requirements.

C. (U) Major Milestones:

	Milestones		Dates
(1) (U)	MIP Computer Replacement Contract Award		August 1980
(2) (U)	Thule Radar Design Phase Contract Award		April 1982
(3) (U)	Thule Radar Design Phase Complete		November 1982
(4) (U)	Thule Radar Upgrade Contract Award		July 1983
(5) (U)	MIP Operational Capability (all three sites)	*(March 1984)	September 1984
(6) (U)	Fylingdales Radar Upgrade Contract Award		April 1986
(7) (U)	Thule Radar IOC	*(December 1986)	October 1986
(8) (U)	Fylingdales Radar IOC		FY 1990

* Data presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES:

(5) Final correction of minor system discrepancies identified during testing deferred turnover to the using command to September 1984.

(7) Reflects reassessment of upgrade schedule.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12424F — Title: SPACETRACK
4 DOD Mission Area: #332 - Strategic Surveillance and Warning — Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		4,995	10,214	9,613	14,212	Continuing	N/A
2295	Ground-Based Electro-Optical Deep Space Surveillance System	1,740	4,585	4,024	4,055	Continuing	N/A
2296	Ground-Based Sensors	3,255	5,629	5,589	10,157	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Soviets continue to pursue a dynamic and expanding military space program, including an operational antisatellite (ASAT) system and satellite reconnaissance systems which are integrated with their ground forces. Our current space surveillance network (SPACETRACK) has [

] This program incorporates near- and far-term operational systems into SPACETRACK in support of satellite attack warning and verification, [

] These research and development efforts will: (1) support the deployment of a five-site global ground-based electro-optical deep space surveillance (GEODSS) system to [ ] out to synchronous altitude and beyond; (2) provide [ ] through the Pacific corridor with Pacific radars (Defense Advanced Research Projects Agency (DARPA) Long-Range Tracking and Instrumentation Radar (ALTAIR) on Kwajalein and GPS-10 radar in the Philippines); (3) provide rapid and accurate calibration of SPACETRACK radars using the Navy Transit satellites; (4) conduct research and development at the Air Force Maui Optical Station (AMOS); (5) transition the Haystack and Kaena Point sites to SPACETRACK for space object identification and satellite mission assessment operational uses; (6) and provide extended range capability for selected SPACETRACK radars. Mission need is documented in ADCOM Statement of Need (SON) 3-79 and Air Force Mission Element Need Statement (AFMENS) for ASAT capability (validated by Secretary of Defense).

Program Element: #12424F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: SPACETRACK
Budget Activity: #3 - Strategic Programs

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	5,009	10,214	9,047		Continuing	N/A
Procurement (Other) *	2,342	13,755	4,874		Continuing	N/A

* Does not include initial spares. Procurement is for projects with Research and Development activity only.

EXPLANATION: (U) The $5.4 million increase in procurement is for a satellite communication terminal at the GEODSS Portugal Station. This requirement was identified in a recent survey.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

		FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
2295	Other Procurement*						
	Funds	1,858	4,935	10,067	7,000	Continuing	N/A
	Quantities	Not Applicable					
	Military Construction	14,100	7,600	14,550	0	Continuing	N/A
2296	Other Procurement*						
	Funds	484	8,820	0	3,980	Continuing	N/A
	Quantities	Not Applicable					
	Military Construction:	0	0	0	4,127	Continuing	N/A

* Does not include initial spares. Procurement is for projects with Research and Development activity only.

5. (U) RELATED ACTIVITIES: SPACETRACK is part of the singly managed Space Defense Systems Program involving four functional areas: Antisatellite, Space Surveillance, Space System Survivability, and Command and Control. SPACETRACK is integrated with those programs which comprise the Space Defense Systems Program: PE 64406F, Space Defense System; PE 12450F, Space Defense Operations; PE 63438F, Satellite Systems Survivability; and PE 12311F, North American Aerospace Defense (NORAD) Cheyenne Mountain Complex (NCMC) Space Defense Systems. The baseline and technology for the GEODSS system and the SPACETRACK improved radar calibration, extended range and radar imaging upgrades were developed and demonstrated under PE 63428F. (Now absorbed into the Strategic Defense Initiative Program, PE 63220D).

6. (U) WORK PERFORMED BY: Program management is provided by Headquarters Space Division, Los Angeles AFS, CA (Project 2296) and Headquarters Electronic Systems Division, Hanscom AFB, MA (Project 2295). TRW, Redondo Beach, CA, is

the prime contractor for the Ground-Based Electro-Optical Deep Space Surveillance System (GEODSS). GEODSS subcontractors are ITEK (cameras), Lexington, MA; Contraves Georz (telescopes), Pittsburgh, PA; and Kentron (operations and maintenance) Honolulu, HI. Avco Everett Research Laboratories Everett, MA, operates the Maui Optical Tracking and Identification Facility (MOTIF) and conducts research and development at the Air Force Maui Optical Site (AMOS). General Electric is extending the range of the Pirinclik, Turkey FPS-79 radar. Western Space and Missile Center (WSMC) is Space Division's agent for Kaena Point SPACETRACK improvements. General systems engineering and technical support is provided by Lincoln Laboratory, Lexington MA; Mitre Corporation, Bedford, MA; and Aerospace Corporation, Los Angeles, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2295, Ground-Based Electro-Optical Deep Space Surveillance (GEODSS). Provides a global network of five sites to optically detect, track and identify satellites in earth orbit at altitudes of 3,000 to 22,000 nautical miles and beyond. In FY 1978 the program concluded four years of development and testing at the experimental site (funded under PE 63428F). Deployment of first three sites and Program Management Responsibility Transfer (PMRT) were completed in FY 83. Construction of the fourth site at Diego Garcia began in late August 1984 and the country-country agreement was signed with Portugal for the fifth site in February 84. In Fiscal Year 1984, procurement of Diego Garcia equipment continued and construction of the technical facility also began in August 1984. Design for the Portugal site will reach 35% completion at the end of CY 1984. The GEODSS Test System (GTS) was built to reduce risk in meeting Initial Operational Capabilities (IOCs) for the Diego Garcia and Portugal sites. In fiscal year 1985, requests for proposals (RFP) for sites four and five equipment installation and checkout will be released. Prime mission equipment (PME) and software unique to the Diego Garcia site will undergo test and evaluation. Test and evaluation of Charge Coupled Device (CCD) prototype cameras will be completed and plans prepared for any modifications necessary. The CCD cameras will provide a significant increase in the ability to detect objects as well as a major increase in equipment reliability. Systems upgrades to increase GEODSS operational effectiveness will be examined and tested including: dynamic (real-time) scheduling, an all-sky camera for cloud monitoring, daylight operations and satellite mission assessment improvements. In fiscal year 1986, construction of the Portugal facility will begin and construction of the Diego Garcia facility will be completed. PME and software unique to Diego Garcia will be installed and checked out. Initial field deployment and installation of CCD camera modifications kits will begin. Research and development efforts will continue. Evaluation will be conducted on system enhancements derived from FY 1985 programs as well as the following: addition of long wavelength infrared (LWIR) detectors, compensated imaging (visible) sensors and mobile GEODSS systems. [

] Cost estimates are based on well established historic data and thus can be placed in Category I (Comprehensive). Although the program is a multi-contract effort, the largest portion rests with a negotiated contract with Lincoln Laboratories, a Federal Contract Research Center (FCRC). Estimates were made in August 1984. This is a continuing program.

B. Project: 2296, Ground-based Sensors: This project provides the Research and Development (R&D) base for pre-planned improvements to the dedicated collateral and contributing radars as well as the Air Force Maui Optical Station (AMOS). Developments [ ] in space object identification and mission assessment capability, and improve surveillance support for space defense. These sensors provide [ ] This project will develop techniques for rapid and accurate calibration of SPACETRACK radars using Navy Transit satellites. Also supported is the transition of Haystack and Kaena Point sites to SPACETRACK and the development of an extended range capability for selected SPACETRACK radars. In fiscal year 1984, modification of the radar at Pirinclik, Turkey for low and high (geosynchronous altitude) capability was completed. Improved radar calibration system modifications to selected radars continued. Upgrades to Kaena Point Radar were accomplished to improve the quality and timeliness of the communication system with North American Aerospace Defense (NORAD) and to increase its dedicated SPACETRACK operation time. Development of the Deep Space Network Control Processor (DSNCP) at Lincoln Laboratories to integrate and coordinate tasking of deep space capable radars continued in fiscal year 1984. The wideband imaging radars provided tactical assessment of domestic satellites for NORAD/Space Command. In fiscal year 1985, preliminary planning is underway to incorporate additional SPACETRACK requirements into the PAVE PAWS missile warning radars. Additional SPACETRACK capabilities are also being incorporated in the new Ballistic Missile Early Warning (BMEWS) radar at Thule, Greenland. The Improved Radar Calibration System (IRCS) program is nearing completion with the Eglin, San Miguel and Pirinclik sites scheduled for completion in October 1985, October 1985, and December 1985, respectively. The Clear, Alaska site is scheduled to be completed in March 1985. Refurbishment of the PACBAR III C-Band radar will be underway in FY 1985. The radar imaging technique development at Lincoln Laboratory/Haystack will continue. The compensated imaging work being done with the AMOS telescope will continue. In fiscal year 1986, the R&D funding will continue the compensated imaging and long-wave infrared system development efforts at the AMOS facility. In addition, development will continue on providing a deep space real-time radar imaging capability at Lincoln Laboratory/Haystack. This effort will serve as a prototype for potential future incorporation into other selected radar sites. The tactical communications upgrades to the Hawaiian Kaena Point C-Band radar will commence as will the Haystack signal processing upgrade. Upgrades to the two new PAVE PAWS radars will be completed in fiscal year 1986. Cost estimates are based on contractor estimates modified by appropriate overhead, reserve and escalation factors. Considering the maturity of the program, this estimate is Category I (Comprehensive). Estimates are current as of August 1984. This is a continuing program.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12431F
DOD Mission Area: [ ]

Title: Defense Support Program (DSP)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	to Completion	Estimated Cost
TOTAL FOR PROGRAM ELEMENT		47,229	63,985	79,592	71,584	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: [

] The system consists of satellites in [ ]geostationary orbital locations, two large processing stations, one simplified processing station, one multi-purpose facility, and a ground communications network. [

]

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	to Completion	Estimated Cost
RDT&E	46,669	63,985	49,884		Continuing	N/A
Missile Procurement	352,830	48,850	209,207		Continuing	N/A
Other Procurement	28,063	70,010	101,855		Continuing	N/A

(U) FY 1986 RDT&E increase of $29.7 million is for software development associated with satellite upgrades, Mobile Ground Terminal test support, and spacecraft related launch charges.

(U) FY 1986 Missile Procurement decrease of $77.9 million reflects a restructuring of procurement between laser crosslinks and the long lead for satellites 18 and 19.

(U) FY 1985 Other Procurement increase of $11.6 million is for additional initial spares for the Mobile Ground System.

(U) FY 1986 Other Procurement increase of $36.8 million is due to refinements in cost data for the peripheral upgrade and the ground station compatibility effort.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	to Completion	Estimated Cost
Missile Procurement (Qty, Satellites)	352,830 (2)	48,600 (0)	131,282 (0)	374,430 Long Lead	Continuing	N/A

Program Element: #12431F
DOD Mission Area: [ ]

Title: Defense Support Program (DSP)
Budget Activity: #3 - Strategic Programs

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement	29,630	81,579	138,675	122,051	Continuing	N/A
Military Construction		8,250			Continuing	N/A
Operations and Maintenance (Software)	26,641	39,485	38,654	32,002	Continuing	N/A

5. RELATED ACTIVITIES: Defense Satellite Communications System (P.E. 33110F and 33605F) provides primary communications routing for DSP overseas data and will help provide Mobile Ground System communications. Space Boosters (P.E. 35119F) provides Titan III (34D) and Complementary Expendable Launch Vehicle launch support. Space Launch Support Program (P.E. 35171F) will provide Inertial Upper Stages and any Space Shuttle flights for DSP missions. [

]

6. WORK PERFORMED BY: Commander-in-Chief, Aerospace Defense Command, maintains operational control of DSP for the Joint Chiefs of Staff. Space Command and the Air Force Communications Command are the system operators and maintainers of the DSP ground stations. Air Force Systems Command's Space Division, Los Angeles Air Force Station, CA, has overall development and procurement responsibility and program management of the satellites. The Air Force Logistics Command provides engineering and logistics support. The Air Force Operational Test and Evaluation Center, Kirtland Air Force Base, NM, participates in test and evaluation of selected system segments. TRW, Redondo Beach, CA, is the prime contractor for the spacecraft and satellite integration. Aerojet Electro Systems Company, Azusa, CA, is the prime contractor for the infrared sensor, and the large processing station. [

] IBM, Thousand Oaks, CA, is the prime contractor for all software efforts as well as the prime contractor on the Mobile Ground System. The Aerospace Corporation, El Segundo, CA, furnishes general systems engineering and integration for the DSP System Program Office.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

Program Element: #12431F
DOD Mission Area: [ ]

Title: Defense Support Program (DSP)
Budget Activity: #3 - Strategic Programs

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12431F, Defense Support Program

A. Project Description: This is an operational program in which replacement satellites include evolutionary improvements for performance and survivability. These improvements have been incorporated on satellites 14 and beyond, which are designated DSP-I models. The first DSP-I, which also is the first DSP satellite to be launched by the Space Shuttle, is scheduled for launch in FY 1987. DSP-I is a candidate for launch on the Complementary Expendable Launch Vehicle, and beginning in FY 1988 will be dual compatible with it and the Space Shuttle. Communications survivability will be improved by a satellite-to-satellite laser crosslink [ ] and by mission data message rebroadcast. [ ] An autonomous station-keeping capability will add to satellite on-orbit endurance. Ground processing survivability will be obtained by deploying a Mobile Ground System consisting of six Mobile Ground Terminals, which do the actual data processing; six Mobile Communication Terminals, which provide the primary, hardened, jam resistant link to the users; and other support vehicles to sustain long-term operations in the field. The replacement of the computer peripherals in the ground stations will be continued, as well as modification to the operational software to support improved satellite capabilities. Orbital operations support, satellite maintenance and other efforts associated with maintaining a [ ] structure will continue.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: [ ] The next two launches will be Sensor Evolutionary Development satellites with higher resolution focal planes. The preliminary and critical design reviews for the ground station peripheral replacement were completed. The laser crosslink development was successfully completed and production was begun. The first two Mobile Ground Terminals have been delivered to the Air Force and the Army has delivered the first Jam Resistant Secure Communications Terminal which is being converted to a Limited Communication Vehicle as the first phase in developing the Mobile Communications Terminal.

(2) FY 1985 Program: Satellite 6R, the first Sensor Evolutionary Development satellite, was launched in December 1984. The delivery of the Mobile Ground Terminals (MGT) will be completed and their Initial Operational Test and Evaluation will be conducted by the Air Force Operational Test and Evaluation Center. [

] A major upgrade effort will begin in FY 1985 to make the Mobile Ground Terminals compatible with DSP-I survivability features. The MGT version now in production can support only the pre-DSP-I design. Improvements will include the development of a hybrid Mission Data Message terminal to provide DSP-Milstar compatibility,

equipment to receive and separate the multiplexed links from two satellites, adaptive equalization equipment and improvements to the phased array antenna system [ ] and software to support austere commanding, autonomous ephemeris and second color processing. DSP-I dual compatibility integration will begin for launching with either the Complementary Expendable Launch Vehicle or the Space Shuttle.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Work is planned to continue on integration of DSP satellites for dual compatible launch capability. [ ] Plans are to continue the development and procurement of Mobile Ground Terminal hardware and software upgrades required for compatibility with the survivability enhancements of DSP-I. Development of the conversion of Jam Resistant Secure Communications Terminals into electromagnetic pulse (EMP) resistant and blast hardened Mobile Communications Terminals is planned to continue until the actual conversion begins in FY 1987. The Simplified Processing Station would also be made compatible with DSP-I. FY 1986 funds would continue the Ground Communications Network upgrade which will relieve the current saturated condition and replace obsolete equipment. Funding would also provide General Systems Engineering and Integration. The RDT&E cost estimates for the above were generated by the Program Office using comptroller prepared Independent Cost Estimates, contractor inputs and experience on similar modifications in the past.

(4) (U) Program to Completion: This is a continuing program. RDT&E funding will support satellite system development in support of Department of Defense Requirements. Primary emphasis will be directed toward eliminating or minimizing operational employment deficiencies and vulnerabilities, insuring a launch capability through the use of either the Complementary Expendable Launch Vehicle or the Space Shuttle, the development of a survivable DSP system through the Mobile Ground System and satellite upgrades, and insuring the adequacy of the ground station data processing capability.

C. (U) Major Milestones:

	Milestones	Dates
(1)	[	
(2)		]
(3)	(U) Retrofit of Satellite 5R Complete	January 1983
(4)	(U) Completion of Computer Replacement	June 1983
(5)	(U) Initiation of Peripheral Upgrade	August 1983
(6)	[	]
(7)	(U) First Mobile Ground Terminal Delivery	August 1984
(8)	[	
(9)		]
(10)	(U) Satellite #14 Delivery	1 Q CY 1987

Program Element: #12431F
DOD Mission Area: [ ]

Title: Defense Support Program (DSP)
Budget Activity: #3 - Strategic Programs

Milestones	Dates
(11) (U) Satellite Launches	As required

* Date presented in FY 1985 Descriptive Summary.

(U) EXPLANATION OF MILESTONE CHANGES

(9) (U) Initial Operational Test and Evaluation is currently scheduled to begin in September 1985 and must be completed before there is an initial operational capability.

Budget Activity: 3, Strategic Programs
Program Element: 12431F, Defense Support Program

Test and Evaluation Data

1. Development Test and Evaluation (DT&E): The Defense Support Program was designed, developed, tested and then deployed as an operational system in the early 1970s. The system is a classified space program consisting of surveillance satellites and ground control and data readout stations which present information to the National Command Authorities and military commanders for decision making purposes. Combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) on the prototype Simplified Processing Station was completed in 1978. Over the next several years, four system upgrades will require DT&E. They are the Sensor Evolutionary Development the Mobile Ground System; the Peripheral Upgrade Program; and the DSP-I satellite upgrades.

The Sensor Evolutionary Development satellites will have more infrared detection cells in the focal plane.

The sensor portion of the satellite is being produced by Aerojet Electro Systems Company, and the spacecraft is being produced and integrated by TRW, Incorporated. DT&E has been performed on one satellite at the Aerojet Electro Systems Company and TRW facilities. The remainder of the ground DT&E will be completed during launch preparation scheduled for fiscal year 1985. The ground system software is being modified by IBM Corporation to accommodate the Sensor Evolutionary Development satellites. When the first Sensor Evolutionary Development satellite is launched, Air Force Systems Command will accomplish a system level DT&E to insure the satellite, the ground station hardware and the software work together.

(U) The purpose of the Mobile Ground System is to provide survivability to the Defense Support Program ground processing and communication elements through mobility. It will use the same computer hardware and software as the Simplified Processing Station. The prime contractor is IBM Corporation. DT&E will be accomplished at the system level to ensure that the Mobile Ground System can meet its mobility and communication requirements. System level DT&E has begun, to be followed by IOT&E in late 1985.

Budget Activity: 3, Strategic Programs
Program Element: 12431F, Defense Support Program

(U) The Peripheral Upgrade Program (PUP) will replace all peripheral equipment at the support sites and the operational large processing stations. Replacements provide processing and display capability for the DSP-I improvements and preclude equipment obsolescence and non-supportability. The PUP contract was awarded to Aerojet ElectroSystems Company in September 1983. DT&E will take place in 1985 for the Multipurpose Facility, in 1986 for the CONUS Ground Station, and in 1987 for the Overseas Ground Station. The existing system must remain operational during the peripheral replacement and testing.

DSP-I satellites include several survivability upgrades: a satellite-to-satellite crosslink capability to reduce overseas ground station and communication vulnerability, [ ] a mission data message rebroadcast capability to reduce communication vulnerability, and an autonomous ephemeris capability to allow the satellite to remain operational without regular updates from fixed ground stations. Development of these satellites started in late fiscal year 1981. The first will be delivered in 1987. The DT&E program for these upgrades will be similar to that on the Sensor Evolutionary Development System, including DT&E of the satellite, ground station hardware and software modifications.

2. (U) Operational Test and Evaluation (OT&E):

(U) Simplified Processing Station (SPS):

(U) Combined DT&E and IOT&E was performed on the Defense Support Program (DSP) prototype Simplified Processing Station (SPS) from 26 August 1978 to 6 November 1978 at Vandenberg Air Force Base, California. This combined test was followed by dedicated IOT&E conducted by the Air Force Operational Test and Evaluation Center (AFOTEC), with assistance from the Aerospace Defense Command (operating command for DSP).

Phase I Follow-on Test and Evaluation (FOT&E) of the SPS was conducted by AFOTEC [ ]

Phase II FOT&E of the SPS was conducted by the Strategic Air Command (SAC) [ ] AFOTEC terminated its monitor role upon declaration of FOC.

Budget Activity: 3, Strategic Programs
Program Element: 12431F, Defense Support Program

Large Processing Station Upgrade (LPSU). The LPSU provides the DSP with a maintainable ground computer environment at a CONUS and an overseas site, and accommodates the new Sensor Evolutionary Development.

All test objectives were met except for event correlation, and satellite command processing. Further testing was deferred until IOT&E Phase II, due to limited equipment configuration at the multipurpose facility.

Thirteen major test objectives were addressed through either discrete testing or analysis of test-derived data. The LPSU test results indicated all test objectives were met. and AFOTEC terminated its monitor role.

(U) Mobile Ground System (MGS). Test planning is in progress for the AFOTEC-conducted IOT&E of the DSP Mobile Ground System. MGS IOT&E is scheduled for late 1985. The MGS is being developed to enhance the survivability of DSP data in pre-, trans-, and post-attack environments through use of mobile, truck-mounted data processing, and communications terminals, i.e., Mobile Ground Terminals (MGTs), and Mobile Communications Terminals (MCTs).

Sensor Evolutionary Development (SED). Advance test planning is in progress for SPACECMD-conducted, AFOTEC monitored IOT&E of SED satellites 5R and 6R and ground station software upgrades. SED IOT&E is from January 1985 to January 1986.

The SED design requires new software for each of the ground processing sites. This new software will be compatible with non-SED satellites.

(U) Peripheral Upgrade Program (PUP). Advance test planning is in progress for SPACECMD-conducted, AFOTEC-monitored IOT&E of DSP Peripheral Upgrade Program. PUP IOT&E is mid-1985 to mid-1987. PUP will replace the computer peripherals and software not upgraded during the LPSU program (i.e., disk drives, tape drives, auto switching units, displays, system control console, and system status board).

(U) Survivable Defense Support Program Satellites (DSP-I). Test planning is in progress for the AFOTEC-conducted IOT&E of the survivable Defense Support Program (DSP-I). DSP-I IOT&E is scheduled for late 1987. The DSP-I is a new generation satellite designed to increase satellite survivability and reduce dependence on fixed ground resources. The OT&E concept includes a combined DT&E/IOT&E during the early on-orbit test phase at contractor facilities, and dedicated IOT&E at the CONUS and overseas ground stations. OT&E(1) planning is in progress to assess DSP-I survivability. OT&E(2) will evaluate the operational mission capability.

Budget Activity: 3, Strategic Programs
Program Element: 12431F, Defense Support Program

(U) Ground Communications Network (GCN) Upgrade. Advance test planning is in progress for SPACECMD-conducted, Air Force Operational Test & Evaluation Center (AFOTEC) monitored IOT&E of the DSP ground communication network upgrade. IOT&E is planned for 1985 and 1986. The GCN will replace outdated SIGMA III computers and increase the number of sources and users to the existing GCN network.

(U) OT&E Reports Published:

(U) Simplified Processing Station (SPS) IOT&E Test Plan Final Report, October 1979 (S), AFOTEC.

(U) SPS Phase I FOT&E Final Report, April 1980 (S), AFOTEC.

(U) SPS Phase II FOT&E Final Report, October 1981 (S), Strategic Air Command (SAC).

(U) Large Processing Station Upgrade IOT&E Final Report, April 1983 (S), SAC.

3. (U) System Characteristics:

Characteristics	Objectives	Demonstrated
For the current operational system		

Budget Activity: 3, Strategic Programs
Program Element: 12431F, Defense Support Program

Characteristics	Objectives	Demonstrated
Improvement for Sensor Evolutionary Development and Advanced Atmospheric Burst Locator		
(U) DSP-I Improvements		
Satellite-to-satellite crosslink	TBD	TBD
Mission data message rebroadcast capability		
Two color focal plane		
Autonomous ephemeris		

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
(U) Sensor Evolutionary Development (SED) IOT&E Test Plan	May 1984	May 1984	On schedule
(U) DSP-I IOT&E (1) Draft Test Plan	July 1984	July 1984	Phase I to address DSP-I survivability

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
SED IOT&E		
(U) Missile Ground System (MGS) Test Plan Coordination	March 1985	On schedule
(U) DSP-I IOT&E (1) Final Test Plan	May 1985	On schedule
(U) Ground Communication Network (GCN) Port Expansion IOT&E	June 1985	On schedule
(U) Peripheral Upgrade Program (PUP) IOT&E Phase I	September 1985	At multipurpose facility
(U) MGS IOT&E	September 1985	On schedule
(U) PUP IOT&E Phase II	FY 1986	CONUS Ground Station (CGS). Overseas Ground Station (OGS) to follow in FY 1987.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12432F
DOD Mission Area: #332 - Strategic Surveillance & Warning

Title: SLBM Radar Warning Systems
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,719	12,219	8,235	23,569	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The existing Sea Launched Ballistic Missile (SLBM) detection and warning system consists of the Otis and Beale PAVE PAWS sites, the Perimeter Acquisition Radar Attack Characterization System (PARCS) radar in North Dakota, the FPS-85 radar at Eglin AFB, and the FSS-7 radar at MacDill AFB, FL. [

] As a result, the PAVE PAWS system is being expanded and upgraded to close gaps in coverage to the Southeast (SE) and Southwest (SW) of the United States (CONUS), [ ]

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	3,719	12,219	13,324		55,530	87,1o2
Other Procurement*	100,900	30,906	69,591		106,470	376,454

*Includes spares

(U) The difference in the funding levels depicted in the FY 1985 and FY 1986 Descriptive Summaries reflect deferral of a power upgrade for the Southeast PAVE PAWS site from FY 86 to FY 87. Also, the project is now reflected as a continuing program to ensure the SLBM Warning Systems will keep pace with evolving Tactical Warning/Attack Assessment needs.

PE #: 12432F

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement*	98,084	28,421	14,440	151,768	Continuing	N/A
Military Construction	4,980	8,410	3,550	-0-	Continuing	N/A

*Includes spares

5. RELATED ACTIVITIES: The PAVE PAWS Sea Launched Ballistic Missile (SLBM) Early Warning System is part of the national system for Tactical Warning and Attack Assessment. It provides confirmation of initial launch detection information provided by the [ ] complements the information provided by the Ballistic Missile Early Warning System (PE 12423F) and SPACETRACK (PE 12424F). PAVE PAWS data is provided directly to NORAD, the National Military Command Center, the Strategic Air Command Command Center, and other users via the NORAD Cheyenne Mountain Complex.

6. (U) WORK PERFORMED BY: The prime contractor is Raytheon Corporation, Wayland, MA. Major subcontractors are Control Data Corporation (CDC), Minneapolis, MN (hardware) and TRW, Redondo Beach, CA (software). The program is managed by Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA, in conjunction with the NORAD, Space Command and Air Force Communications Command. General system engineering is being provided by Mitre Corporation, Bedford, MA.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 12432F, SLBM Radar Warning Systems

A. Project Description: The PAVE PAWS expansion program will deploy two new phased array radars, one each in the Southeast (SE) at Robins AFB, GA and in the Southwest (SW) near Goodfellow AFB, TX. These new sites will complement the two sites now in operation in the Northeast (NE) at Otis AFB, MA, and the Northwest (NW) at Beale AFB, CA. Together with the Perimeter Acquisition Radar Attack Characterization System (PARCS) in North Dakota, they will complete the planned five-site phased array SLBM warning network. The program also includes radar power upgrades at three of four PAVE PAWS sites, and computer upgrades at the original Otis and Beale sites. This will greatly improve the system's capability to handle a modern [ ]

The two new PAVE PAWS sites will initially be deployed in a configuration having the same radar power output as the sites at Otis and Beale AFBs. This initial deployment will [ ] It will provide a significant improvement in tactical warning capability, and will permit closing of the MacDill AFB, FL FSS-7 radar site.

Beginning in FY 1987, the Southeast (SE), Northeast (NE) and Northwest (NW) sites will be increased in radar power output capacity. These power upgrades will extend the maximum range of the system from less than [ ] nautical miles. In addition, the NE and NW sites will undergo a computer upgrade. These changes will allow the systems to detect and track smaller objects, [ ] and provide improved detection probability. An additional power upgrade to the SE site will allow PAVE PAWS to perform the spacetracking functions of the obsolescent FPS-85 radar at Eglin, and permit its subsequent closure.

B. (U) Program Accomplishments And Future Efforts:

(1) (U) FY 1984 Accomplishments: Work continued on schedule for the SE site. Design reviews were completed and groundbreaking took place in April 1984. A contract option for the SW site was executed in January 1984.

(2) (U) FY 1985 Program: Software development, system engineering, component fabrication, and test planning continue for the SE and SW sites. In-plant test activities will commence. Groundbreaking for the SW site took place in October 1984. Both the SE and SW site structures will be completed in preparation for equipment installation and checkout efforts.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In-plant testing on equipment and software for the SE site will be completed and installation and checkout will take place at Robins AFB, GA. On-site testing will commence, leading to a projected initial operational capability (IOC) in December 1986. The SW site equipment will undergo in-plant string testing, followed by shipment to the operational location near Goodfellow AFB in Texas for installation, checkout and on-site testing. The budgetary cost estimate is based on contract line items and negotiated options on the PAVE PAWS contract currently in effect.

(4) (U) Program to Completion: The SW site will attain initial operational capability in early calendar year 1987. Also in 1987, contract options will be executed to provide for power upgrades to the SE, NE, and NW sites. New automated data processing equipment will be acquired for the NE and NW sites to provide for system-wide commonality. This is a continuing program; additional efforts will be implemented as necessary to accomodate Tactical Warning/Attack Assessment requirements.

C. (U) Major Milestones

		Milestones		Dates
(1)	(U)	Contract Award		November 1983
(2)	(U)	SE Site IOC		November 1986
(3)	(U)	SW site IOC	*December 1986	May 1987
(4)	(U)	SE site modification complete	*September 1988	September 1989
(5)	(U)	NE site modification complete	*September 1988	December 1989
(6)	(U)	NW site power upgrade complete	*March 1989	March 1990

*Data presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(2), (3) The Southeast and Southwest sites' initial operational capability (IOC) dates have undergone a slight adjustment to allow for efficient phasing of test and evaluation schedules.

(4), (5), (6) The changes to the Northeast, Northwest and Southeast upgrade dates reflect deferral of the start of the Southeast upgrade from FY 86 to FY 87, and subsequent rephasing of the Northeast and Northwest upgrade efforts to optimize test and evaluation scheduling and minimize operational impact.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12433F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Integrated Operational NUDET Detection System (IONDS)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Estimate	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		32,170	34,795	20,538	4,084	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The validated Strategic Air Command/Aerospace Defense Command Required Operational Capability 4-77, defines requirements for a highly survivable capability to detect, locate, and report nuclear detonations (NUDETS) on a global basis in near real time. The Integrated Operational NUDET Detection System (IONDS) (also known as the NUDET Detection System (NDS)) will consist of sensors on the operational 18-satellite NAVSTAR Global Positioning System. NUDET information supports post-impact selection of appropriate retaliatory options in response to a nuclear attack against North America, as well as strike confirmation, and damage assessment. NUDET detection information is vital to the effective management of U.S. forces through the trans- and post-attack phases of any nuclear conflict. Reports to command centers of weapon effectiveness will be vital in managing strategic reserve forces and reestablishing a command structure. IONDS data could be a major information component during negotiations to terminate a nuclear conflict. [

]

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	30,170	34,795	15,358		Continuing	N/A
Missile Procurement	23,429	21,330	22,354		Continuing	N/A
Other Procurement*	0	9,967	0		Continuing	N/A

*Includes funding for initial spares.

(U) Explanation of changes: The increase in RDT&E funding is due to the acquisition of a development terminal for Initial Operational Test and Evaluation (IOT&E) and certification in the fixed ground command center network.

PE #: 12433F

Program Element: #12433F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Integrated Operational NUDET Detection System (IONDS)
Budget Activity: #3 - Strategic Programs

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Estimate	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement:						
Funds	23,429	21,330	22,299	26,325	Continuing	N/A
Quantities	1	6	9	8	Continuing	N/A
Other Procurement:						
Funds*	0	8,980	0	11,630	Continuing	N/A
Quantities	0	4	0	4	Continuing	N/A

*Includes initial spares

5. RELATED ACTIVITIES: IONDS sensors are flown on all Global Positioning System (GPS) satellites (PE 35165F) beginning with the IONDS/GPS launch in July 1983. Development and production of the X-ray and optical NUDET sensors for IONDS/GPS are funded by the Department of Energy, with support from [ ] Production of the airborne IONDS terminals, to begin in FY 1987, will be funded in the Worldwide Airborne Command Post, PEs 11312F and 32015F.

6. (U) WORK PERFORMED BY: System development and procurement is accomplished by HQ Space Division, Los Angeles, CA with the assistance of the Air Force Technical Applications Center, Patrick AFB, FL. Rockwell International, Seal Beach, CA, is currently under contract to integrate IONDS sensors on GPS satellites and produce the Electromagnetic Pulse (EMP) sensor. Ford Aerospace and Communications Corporation, Palo Alto, CA , and the Aerospace Corporation, El Segundo, CA provide systems engineering support. Sandia National Laboratories, Albuquerque, NM and Los Alamos National Laboratory, Los Alamos, NM, are under contract to the Department of Energy to produce the x-ray and optical nuclear detonation sensors. Texas Instruments, Dallas, TX, is developing and will produce the user terminals. E-Systems, Garland, TX, is developing the EMP receiver/processor for the satellite.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12433F, Integrated Operational NUDET Detection System

Program Element: #12433F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Integrated Operational NUDET Detection System (IONDS)
Budget Activity: #3 - Strategic Programs

A. Project Description: IONDS consists of payloads on the operational eighteen satellite NAVSTAR Global Positioning System (GPS) constellation. These sensors, coupled with the extremely precise GPS timing capability, will provide location of nuclear bursts worldwide [ ] Nuclear detonation data are transmitted directly to IONDS users. The data are also crosslinked to other GPS/IONDS satellites which act as relay points. This crosslinking of information, when used with 18 satellites, will allow a user on one side of the earth to receive data of a detonation on the opposite side. It also provides multiple redundancy of the data transmission for increased system availability and survivability. A broad range of users (National Command Authorities, Strategic Air Command, Aerospace Defense Command, other Unified and Specified Commands, [ ] will receive NUDET data on precise location, yield, count, time, and height of burst direct from the spacecraft.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: IONDS Payloads were installed on the final four validation phase GPS spacecraft. The second and third GPS spacecraft with IONDS were successfully launched in FY 1984. The Preliminary Design Review for the user terminal development was completed. These terminals are being designed to be compatible with the the E-4B and the EC-135 airborne command posts and the ground-based command centers, and will receive data direct from the satellites. The Preliminary Design Review for the EMP sensor was successfully completed. The EMP sensor, along with the DOE developed sensors, will be integrated onto the GPS spacecraft. The EMP sensor will improve IONDS' location accuracy to provide a hard target strike and damage assessment capability.

(2) (U) FY 1985 Program: The FY 1985 program will continue integration of IONDS sensors on NAVSTAR Global Positioning System (GPS) satellites and continue development of an electromagnetic pulse (EMP) sensor. Additionally, the ground and airborne terminal development effort will continue in FY 1985 with a Critical Design Review scheduled for mid CY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Key elements in obtaining the required NUDET information are the extremely precise timing and global coverage provided by the GPS constellation of satellites. Therefore, the IONDS validation and production phases exactly match those of GPS. Development and integration efforts on the EMP sensor will continue. Work will also continue on the production spacecraft leading to the first delivery in FY 1986. Development of the ground and airborne user terminals, initiated in FY 1983, will progress with integration of the first unit scheduled for late CY 1986 on an EC-135C aircraft. The cost estimates were derived from a System Program Office cost evaluation using contractor estimates, historical data from similar efforts, and cost estimating relationships. Sixty-three percent of the cost estimate is based on a firm fixed price multi-year contract.

(4) (U) Program to Completion: This is a continuing program. IONDS design and production are keyed to the GPS schedule.

PE #: 12433F

Program Element: #12433F
DOD Mission Area: #332 - Strategic Surveillance and Warning

Title: Integrated Operational NUDET Detection System (IONDS)
Budget Activity: #3 - Strategic Programs

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Defense Systems Acquisition Review Council II	June 1979
(2) (U) Begin Satellite Production	August 1982
(3) (U) Launch 1st GPS/IONDS Spacecraft	July 1983
(4) (U) Start User Terminal IOT&E (EC-135)	1Q FY 1987
(5) (U) Launch 1st Operational Satellite (Shuttle)	1Q FY 1987
(6) (U) Achieve Worldwide 2-Dimensional NUDET Location Capability	1Q CY 1988
(7) (U) Achieve Worldwide 3-Dimensional NUDET Location Capability	1Q FY 1989

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12436F
DOD Mission Area: #391 - Strategic Information Systems

Title: Command Center Processing and Display System
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,966	11,661	14,807	23,888	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Strategic Air Command (SAC) Statement of Need (SON) 1-80 identified the requirement for an upgraded Command Center Processing and Display System (CCPDS). The CCPDS consists of dedicated computers, software, display devices, and consoles at the National Military Command Center (NMCC) and its alternate (ANMCC), the North American Aerospace Defense (NORAD) Command Center in the NORAD Cheyenne Mountain Complex (NCMC), and the Headquarters SAC Command Post (SACCP). The CCPDS provides for the reception and processing of ballistic missile Tactical Warning and Attack Assessment (TW/AA) information. A common display of attack data is provided to the National Command Authority (NCA), Commander-in-Chief of SAC (CINCSAC), and Commander-in-Chief of NORAD (CINCNORAD), for their use in making decisions related to our nuclear force survival, [ ]and the use of strategic reserve forces during the pre-, trans- and post-attack phases of a nuclear engagement. [ ]

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,966	11,661	19,136		Continuing	N/A
Other Procurement	0	0	16,086		Continuing	N/A

FY 1986 RDT&E funds were increased to agree with latest cost estimate. FY 1986 Procurement funds are not required.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	0	0	0	30,118	Continuing	N/A
Quantities	Not Applicable					

5. (U) RELATED ACTIVITIES: PE #12313F, Ballistic Missile Tactical Warning/Attack Assessment (TW/AA) Support, funded development of the System Operations Concept, system hardware and software acquisition specifications, Request for Proposal, and Statement of Work documentation during FY 1983. The Defense Communications Agency will program the required funds for the Command Center Processing and Display System (CCPDS) installation at the National Military Command Center (NMCC) and the Alternate NMCC (ANMCC) under PE #32018K, National Military Command System Wide Support-Automatic Data Processing.

6. (U) WORK PERFORMED BY: The effort is managed by Air Force Systems Command's Electronic Systems Division ...ted at Hanscom AFB, MA. Prime contractors have not yet been identified. Preliminary acquisition documentation was developed by Mitre Corporation, a Federal Contract Research Center (FCRC), located in Bedford, MA.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 12436F, Command Center Processing and Display System

A. (U) Project Description: The CCPDS-Replacement (CCPDS-R) program will provide new equipment to the command centers to resolve identified deficiencies and provide the decision makers at each of the four command centers a consolidated, common presentation for evaluation of the missile threat. The acquisition approach is a two-phase contractual process. The first phase will be a Competitive Design (CD), in which two contractors will submit a program design, perform various trade studies, and submit their proposals for Phase Two, Full Scale Development (FSD). One of the two CD contractors will be selected to develop, test, and install the CCPDS-R during the FSD phase. The FSD phase will consist of at least two separate acquisition blocks. Block A will incorporate all the hardware and software capabilities necessary to satisfy the common TW/AA requirements at the command centers. Block B will provide the hardware and software to satisfy the unique TW/AA mission requirements at each center.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: During this period the Air Force prepared the acquisition documentation and the formal Request For Proposal (RFP).

(2) (U) FY 1985 Program: The RFP was released to industry and source selection was initiated. Proposal evaluation will be completed and competitive design contracts will be awarded to at least two contractors. The competitive design phase will provide the necessary trade-off studies and alternate system architectures to determine the most mission responsive, cost effective approach to the CCPDS-R program.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The winning contractor of the competitive design effort will be awarded the contract for the design and development of the proposed system. A software development system will be acquired, and Block A software design, coding, and testing for the operational system will be initiated.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Strategic Air Command Statement of Operational Need 1-80		May 1980
(2)	(U)	Design Definition Contract Award	*(November 1984)	May 1985
(3)	(U)	Block A Contract Award	*(November 1985)	May 1986
(4)	(U)	Block A Critical Design Review	*(November 1986)	May 1987
(5)	(U)	Block B Contract Award	*(November 1986)	May 1987
(6)	(U)	Block B Critical Design Review	*(4Q FY 1987)	3Q FY 1988
(8)	(U)	Block A Initial Operational Capability	*(2Q FY 1988)	4Q FY 1989
(9)	(U)	Block B Initial Operational Capability	*(2Q FY 1989)	3Q FY 1990

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) Explanation of Milestone Changes

Program has been restructured to encompass tactical warning information from space and air threats as well as ballistic missiles. This restructure delayed program initiations and decision points, and caused a consequent delay in Initial Operational Capability.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: #333 - Strategic Communications Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	111,750	111,811	97,199	36,001	Continuing	N/A
2832	VLF/LF Improvements	35,642	35,835	73,099	34,901	Continuing	N/A
2833	Automatic Communications Processor (ACP)	9,208	4,332	Transferred to PE 41840F			
2834	Groundwave Emergency Network (GWEN)	66,900	71,644	24,100	1,100	3,188	190,132

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element is the Air Force portion of a continuing program supporting the Chairman, Joint Chiefs of Staff, who is responsible for delivery of decisions of the National Command Authority in a precise and timely manner to [ ] Current emphasis is on improved command and control communications to improve survivability, endurability and performance under adverse nuclear and jamming conditions. The Minimum Essential Emergency Communications Network consists of communication systems specifically designed to [ ]

Communications in the very-low-frequency and low-frequency regions of the spectrum have attributes useful in strategic communications. These include low ambient propagation loss, significant penetration of sea water, and good performance in a nuclear disturbed environment.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	107,751	116,900	68,507	N/A	Continuing	N/A
Other Procurement	0	6,825	96,916	N/A	Continuing	N/A
Aircraft Procurement	0	500	27,000	N/A	Continuing	N/A
Military Construction	0	1,200	1,600		2,800	5,650

(U) Explanation of Differences

(U) RDT&E FY 85: The PE was reduced by $5.089 Million as an amendment to FY 85 President's Budget submitted to Congress. Project 2832 was reduced from $40.835 Million to $35.835 Million as a result of delays in the development program. Project 2834 was reduced from $71.733 Million to $71.644 Million due to administrative adjustment. FY 86: The PE was increased by $28,692 Million. Project 2832 was increased by $18.975 Million because of delays in the development schedule. Project 2833 was decreased by $10.608 Million because the Phase II Adaptive High Frequency program was cancelled. It was cancelled because the using commands supported other more critical programs. Project 2834 was increased by $20.325 Million to complete ground prototype and complete airborne and missile prototypes.

(U) Procurement (Other) FY 1986: The PE was reduced by a total of $77.075 Million. Project 2832 was reduced by $29.724 Million because the full scale development program stretched delaying the start of production. Project 2833 was reduced by $6.180 Million. The procurement funds were transfered to PE 41840 which contains procurements supporting other Military Airlift Command, Command and Control upgrade programs. Project 2834 was reduced by $41.171 Million as part of general reduction over many programs to remain within fiscal guidance.

(U) Procurement (Aircraft) FY 85: The PE was reduced by $500 Thousand as an administrative clean up. FY 86: Project 2832 was reduced by $27.000 Million. The start of the production was delayed to allow completion of testing.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
TOTAL	0	0	0	119,100	TBD	TBD
PE 33131F MEECN						
Project 2832	0	0	0	75,000	TBD	TBD
PE 32015F National Emergency Airborne Command Post						
Project 2832	0	0	0	9,900	14,000	23,900
Project 2834	0	0	0	2,100	2,000	4,100

Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: #333 - Strategic Communications Budget Activity: #3 - Strategic Programs

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	to Completion	Estimated Cost
PE 11312F Post Attack Command and Control System						
Project 2832	0	0	0	20,700	TBD	TBD
Project 2834	0	0	0	11,400	27,100	38,500
Missile Procurement:						
TOTAL	0	0	8,440	9,349	0	17,789
PE 11213F Minuteman Squadrons						
Project 2834	0	0	8,440	9,349	0	17,789
Other Procurement:						
TOTAL	0	5,901	19,841	142,356	Continuing	N/A
PE 33131F MEECN						
Project 2832	0	0	0	11,710	Continuing	N/A
Project 2833	0	5,901	Transferred to PE 41840			
Project 2834	0	0	19,841	130,646	345,277	495,764
Military Construction:						
TOTAL	0	0	0	1,372	1,372	2,744
PE 33131F MEECN						
Project 2834	0	0	0	1,372	1,372	2,744

5. (U) RELATED ACTIVITIES: Modifications to ground and airborne systems resulting from improvements developed under this program are funded in several program elements. PE 11312F, Post Attack Command and Control System, contains funding for Very Low Frequency/Low Frequency (VLF/LF) transmitter modifications, VLF/LF receiver modifications, and Ground Wave Emergency Network (GWEN) terminals for the EC-135 airborne command posts. PE 32015F, National Emergency Airborne Command Post, contains funding for VLF/LF receiver modifications and GWEN terminals for the E-4B aircraft. PE 11213F, Minuteman Squadrons, contains funding for GWEN terminal integration into the Minuteman launch control centers.

6. (U) WORK PERFORMED BY: Air Force Systems Command's Electronic Systems Division located at Hanscom AFB, MA, has managerial responsibility for the Research, Development, Test, and Evaluation, with support from the Rome Air Development Center, Air Force Logistics Command, Strategic Air Command, and other Air Force major commands. Primary contractors are Analytical Systems Engineering Corporation, Burlington, MA (system engineering support); Mitre Corp., Bedford, MA (system engineering support); Westinghouse Electric Corporation, Defense and Electronic Systems Center, Baltimore, MD (jam-resistant modulators/demodulators, high-power (100 Kilowatt) airborne transmitter for EC-135 aircraft and Miniature Receive Terminals); Spears Associates, Norwood, MA (horizontally polarized airborne receive antenna Sonicraft, Incorporated, Chicago, IL (Diversity Reception Equipment); Rockwell International, Richardson, TX (Miniature Receive Terminals); R&D Associates, Marina Del Ray, CA (Groundwave Emergency Network); RCA, Camden, NJ (Groundwave Emergency Network).

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2832, VLF/LF Improvements

A. (U) Project Description: This project consists of improvements to our existing very-low-frequency/low-frequency communications system to extend range, improve resistance to jamming and nuclear effects, and increase message accuracy at all ranges. The system consists of (1) airborne transmitters and receivers in EC-135 and E-4B airborne command post aircraft; (2) transmitters and receivers at fixed ground locations at Silver Creek, Nebraska and Hawes, California; and (3) receivers at selected Strategic Air Command command posts and combat operation centers, missile launch control centers, and northern area radio relay sites. The system improvements are based upon validated requirements of the Strategic Air Command and the other Single Integrated Operational Plan Commanders-in-Chief, system deficiencies as reported by the Defense Communications Agency, and priorities of the Joint Chiefs of Staff.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Production and installation for the horizontally polarized airborne receive antenna continued via an aircraft modification contract. Full scale development of the 100 Kilowatt (KW) airborne transmitter was completed but development, test and evaluation was stopped due to testing failures when the transmitter was interfaced with the existing transmit antenna system. The existing single wire antenna was not part of the development program. When the 100 KW transmitter began testing, the power output was too great for the existing antenna

and high voltage arcing occurred between the antenna and the aircraft. This condition posed a safety problem and testing was stopped until further analysis could be completed on the antenna system. Subsequently, we have determined that a new dual wire antenna will be needed to work with the 100 KW transmitter. Alternative dual wire antenna solution were proposed but none of these alternatives have been implemented. The initial Critical Design Review on the Diversity Reception Equipment was held in Mar 84. A competitive validation phase for the Miniature Receive Terminals for bombers began in Jan 83 and limited Critical Design Reviews were held in Nov 83.

(2) (U) FY 1985 Program: The Critical Design Review for the Diversity Reception Equipment should be completed by Jun 85. Competitive flight testing for the validation phase of the Miniature Receive Terminal was held in Oct/Nov 84. Planning continues for a new higher power transmitter/dual wire antenna system Full Scale Development (FSD) program in FY 1987 to meet the Strategic Air Command requirement for increased range and improved connectivity.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The request includes funds to continue development of the upgrades to our current Survivable Low Frequency Communication System (487L). Full scale development will continue for the Diversity Reception Equipment (DRE). The Miniature Receive Terminal (MRT) full scale development will be continued and flight testing will begin. Planning for a higher power transmitter/dual wire antenna system will continue with request for proposal preparation and system specification development. The cost estimates for DRE are based on contractor proposals while estimates for MRT and the improved antenna are based on independent cost estimates done by Electronic Systems Division. Estimates are based on a competitive procurement strategy.

(4) (U) Program to Completion: The development programs will be completed for the DRE and MRT in FY 1987 and then these programs will transition into production. FSD development of an improved high power transmitter/dual wire antenna system is planned to begin in FY 1987. This is a continuing program which evolves as the threat to our strategic communications grows. It must assure a high probability of successful communications to our strategic forces is maintained at all times.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) 100 KW Airborne Transmitter	
- Contract Award	October 79
- Development Complete	November 82
- Testing Complete	April 84

(2) (U) Horizontal Polarized Airborne Receive Antenna			
- Development Contract Award		July	80
- Production Contract Award		August	82
- Full Operational Capability (FOC)		FY	87
(3) (U) Diversity Reception Equipment			
- Development Contract Award		June	82
- Production Contract Award	*(FY 86)	FY	88
- FOC	*(FY 90)	FY	92
(4) (U) Miniature Receive Terminals			
- Validation Contract Award		January	83
- Development Contract Award		FY	85
- Production Contract Award	*(FY 87)	FY	88
- FOC	*(FY 90)	FY	95
(5) (U) Improved Higher Power Transmitter/Dual Wire Antenna			
- Development Contract Award	*(FY 86)	FY	87
- Production Contract Award	*(FY 89)	FY	90
- FOC	*(FY 92)	FY	93

* Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES:

(3) (U) Stretchout of development program delays production start and FOC.
(4) (U) Stretchout of development program delays production start and FOC.
(5) (U) Program start delayed due to higher priority requirements.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2834, Groundwave Emergency Network

Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: #333 - Strategic Communications Budget Activity: #3 - Strategic Programs

A. Project Description: This project will define, develop, test, and deploy a proliferated groundwave communitions system. The purpose of this system is to provide U.S. strategic forces with the ability to maintain critical continental United States long-range command and control communications connectivity despite destruction of relay terminal sites and ionospheric disturbances caused by nuclear detonations. The network will handle low speed data messages (100 words per minute) for [ ] CONUS commanders, bomber and tanker forces, and missile launch control centers. The program is divided into three phases. Phase I is the Initial Connectivity Capability (ICC) and is the concept validation phase. Phase II is the Thin Line Connectivity Capability (TLCC) and is the prototype network. In Phase III the network will be expanded into a final operational capability. Survivability for this system is provided primarily by proliferated relay nodes, using unmanned, electromagnetic pulse (EMP) hardened, jam-resistant, low-frequency, groundwave radio equipment. Strategic force commanders and units (equipped with EMP-hardened, jam-resistant, secure radio equipment) interact with nearby relay nodes for participation in the overall network.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Installation and contractor testing were completed on the ICC (a nine relay station proof of concept network). Software protocols, user interfaces, and EMP hardening techniques were developed and tested during this year. The competitive design contracts for the prototype TLCC network were completed in Oct 1983. The contract for fabrication and deployment of the TLCC prototype network was awarded to RCA in Oct 1983.

(2) (U) FY 1985 Program: Hardware and software demonstration and operational procedure development will continue on the ICC network through the summer of 1985. Installation of the TLCC network was started in late 1984 and continues through FY 1985. The ICC stations will undergo modifications to become part of the TLCC network. Development of terminals for the missile launch control centers and airborne command posts will also begin.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 includes funds to complete fabrication and deployment of the prototype Thin Line Connectivity Capability (TLCC) network. The TLCC includes 57 relay stations (including the nine from Initial Connectivity Capability (ICC)), eight input/output locations, and 30 receive only terminals. Deployment of the network will be completed by Nov 1985 and contractor testing will begin. The Air Force will conduct independent operational test and evaluation from Dec 85 to Feb 86. Following testing, the prototype will become the initial operational capability providing EMP hardened connectivity between warning sites, major command centers, bomber and tanker bases, and missile control centers. The Air Force will then exercise a production option on the development contract to begin the production and installation of relay stations toward final operational capability. Prototyping of missile and airborne terminals will be also completed in FY 1986.

(4) (U) Program to Completion: Production and installation of relay stations will continue through FY 1989. Production and installation of missile and airborne terminals will begin late in FY 1986. Missile terminals should be completed in FY 1988 while airborne terminals will continue into FY 1989.

C. (U) Major Milestones:

		Milestones	Dates	
(1)	(U)	Initial Connectivity Capability (ICC) Contract Award	June	1982
(2)	(U)	Thin Line Connectivity Capability (TLCC) Design Contract Award	February	1983
(3)	(U)	TLCC Fabrication/Deployment Contract Award	October	1983
(4)	(U)	ICC Test Complete	April	1984
(5)	(U)	TLCC Development Completed	FY	1986
(6)	(U)	Initial Operational Capability	FY	1986
(7)	(U)	Full Operational Capability	FY	1989

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33152F
DOD Mission Area: #391 - Strategic Information Systems

Title: USAF Worldwide Military Command and Control System (WWMCCS) Information System (WIS)
Budget Activity #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0*	0*	8,100	8,387	26,610	43,097
3155	USAF WWMCCS Information System	0*	0*	8,100	8,387	26,610	43,097

* Previous efforts in this area funded in WWMCCS Architecture Program (PE63735F) and the WIS Joint Program Manager (PE33154F).

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Requirement based upon the WIS Joint Mission Element Needs Statement (JMENS), 9 Feb 1982. The WWMCCS Standard Automatic Data Processing (ADP) system, which was acquired in the early 1970's, is becoming obsolete and increasingly uneconomical to maintain and operate. Substantial deficiencies have emerged, particularly in time sensitive operations. The same is true of the Air Force application software, which makes up the majority of the software run on the WWMCCS ADP at AF sites. Pursuant to the need stated in the WIS JMENS, the Air Force must: (a) Support Joint Mission Requirements; (b) modernize the Air Force standard and Major Command-unique applications; (c) install and exploit the modernized standard WIS to support the Air Force mission; (d) address Air Force-unique extensions of hardware capability and connectivity to support command and control requirements interfacing with or supporting WIS.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total
Other Procurement:						
Funds	0	0	16,349	55,587	125,583	197,519
Quantities	Not Applicable					

5. (U) RELATED ACTIVITIES: This program is closely related to the WWMCCS Information System Joint Program (PE 33154F) in that it builds upon the capability provided by that program. It augments WIS hardware and software in order to meet the unique command and control requirements of the Air Force. The Joint WIS System Program Office (SPO) and the Air Force WIS SPO are co-located at Hanscom AFB, MA. A life cycle management office for AF WIS will be

established within Air Force Communications Command. This office will co-locate a detachment with the Air Force WIS SPO, and will inter-operate and establish Memoranda of Agreement with the SPO and the Air Force WIS sites. The life cycle management office will be funded under PE 33152F.

6. (U) WORK PERFORMED BY: The primary element of work is to be performed by the MITRE Corporation, Bedford, MA. Additional work will be performed by Dynamics Research Corp, Wilmington, MA. The Air Force WIS System Program Office (SPO) is assigned to Electronic Systems Division, Hanscom AFB, MA, Air Force Systems Command.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3155, Air Force WWMCCS Information System

A. (U) Project Description: This program will provide Air Force-unique support to the Joint Mission requirements stated in the WIS Joint Mission Element Needs Statement (JMENS), modernize Air Force standard and Major Command-unique application software, and install and exploit the modernized WIS standard hardware and software to support the Air Force mission. To do so, the program office will develop planning documents in the areas of program management, security, test and evaluation, logistics, computer program development and site installations. Site-unique architectures and interface specifications will be developed and the WIS hardware and software systems will be installed at Air Force sites.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Integration and Common User contracts awarded by WIS Joint Program Manager.

(2) (U) FY 1985 Program: Program directive requires certain actions to be performed in FY 1985. These include development of an AFWIS master plan, a program management plan, a logistics support plan, and a computer resources integrated support plan.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The following activities will be conducted in FY 1986: Develop site unique architectures and configuration definitions that integrate with the joint WWMCCS Information System; develop Interface Control Documents; develop AFWIS Integration and Transition Plans and Select an Integration Contractor. These activities must take place in FY 1986 in order for the Air Force sites to be prepared for WIS installations projected in the Joint WIS site installation schedule. The funding stated in this document is an April 1984 budgetary estimate. The program is in the advanced development stage and the estimate is based upon competition.

(4) (U) Program to Completion: After FY 1986 all site installations will take place in at least two cycles. Additional Air Force and site-unique software will be developed and unique interfaces, if any, will be designed and developed. Program continues until FY 1989 when all sites are turned over to the life cycle manager.

C. (U) Major Milestones:

Milestones	Dates
(1) Integration Contract Award	March 1986
(2) Completion of Site Integration Plans	August 1986
(3) First Operational Site Installation (Block A)	January 1987
(4) First Block B Installation	March 1988
(5) Completion of Block A Installations	October 1988
(6) Final Site Turnover to Manager	November 1989

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33154F
DOD Mission Area: #391 - Strategic Information Systems

Title: WWMCCS Information System (WIS) Joint Program Management Office (JPMO)
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		25,005	32,629	88,721	147,073	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The WIS program was directed by the Deputy Secretary of Defense to develop a modernized automatic data processing (ADP) system to provide command and control (C^2) information for the national command authorities (NCA); to support strategic and conventional planning and command of forces; to provide an effective crisis action management system; to support execution planning and monitoring; and to provide supportability and sustainability of information for command and support of forces. The existing Worldwide Military Command and Control System (WWMCCS) ADP, acquired in the early 1970s and based on system concepts, procedures and technology from the 1960s, does not fully support current information requirements of WWMCCS users. WIS will provide significantly improved C^2 support for use by the NCA; the Joint Chiefs of Staff (JCS); unified, specified, and component commands; and other C^2 organizations throughout the Department of Defense. WIS replaces the WWMCCS Standard ADP software, hardware, and directly related telecommunications which have become increasingly expensive and difficult to maintain. Key elements are modernization of the current software, and development of automated message handling and other new software to support decision makers' C^2 requirements as approved by the JCS.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	25,005	32,629	50,070		Continuing	N/A
Other Procurement	0	5,703	6,914		Continuing	N/A

EXPLANATION: (U) Increase in RDT&E supports software development shortfall and Ada foundation development. Decrease Procurement reflects reduced WIS early product requirements and transfers to RDT&E.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	0	2,203	0	0	0	2,203
Quantities Not Applicable						

5. (U) RELATED ACTIVITIES: Program Elements 33151F (WWMCCS-ADP) and 41841F (WWMCCS ADP-Military Airlift Command) fund

PE #: 33154F

current WWMCCS ADP. PE 33152F (WIS) funds Air Force unique software development, site preparation and procurement of WIS at Air Force sites. PEs 33152N (WIS) and 33152A (WIS) partially fund the WIS R&D program described by this document and managed by the WIS JPM, as well as fund WIS procurement and service/site unique modernization programs closely coordinated with the WIS JPM effort.

6. (U) WORK PERFORMED BY: The WIS JPM is responsible for overall program management. Air Force Systems Command, Electronic Systems Division is responsible for the development and acquisition of joint WIS. The primary contractors in FY 1985 are GTE, Billerica, MA; IBM, Gaithersburg, MD; MITRE, McLean, VA/Bedford, MA; and a firm to be selected for the system support contract. The primary contractors in FY 1984 were GTE, Billerica, MA; MITRE, McLean, VA/Bedford, MA; Honeywell, McLean, VA; TRW, Redondo Beach, CA; and GTE Automatic Elec, Phoenix, AZ. Other contractor efforts in FY 1984 totaled $12.4M.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 33154F, WWMCCS Information System Joint Program Management Office

A. (U) Project Description: WIS is a multi-phased, multi-contract evolutionary program designed to modernize the standard automatic data processing (ADP) of the Worldwide Military Command and Control System (WWMCCS). The program includes the transition to the new WIS stressing modernization of software first, utilizing the Ada computer programming language. The program provides for the modernization of the WWMCCS Standard ADP for the Joint Chiefs of Staff, unified/specified/component commands, Defense Communications Agency, and Defense Nuclear Agency. The government will manage and integrate the work of three primary contractors, and a system support contractor. Capabilities will be tested and deployed incrementally to preclude interruption to the command and control mission.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The integration contract tasks included initial preparation of a detailed definition of WIS, development of functional descriptions, development of a site installation and integration plan, definition of WIS security approach, and establishment of a Development and Evaluation Facility (DEF). Groundwork was laid for award of the system support and common user contracts. Precursor activities to reduce cost, schedule and technical risk were conducted. Development of Ada software foundation was continued.

(2) (U) FY 1985 Program: The integration contractor will develop a local area network and an integrated software development and maintenance environment, continue development of functional descriptions, operate the DEF, plan logistics support, develop program standards, and continue other efforts begun in FY 1984. Design will begin on the first release of joint mission software. The common user contract was awarded and the contractor begins development of

the automated message handling software, begins deployment of intelligent workstations and processors (as early products) and installs development systems in the Development and Evaluation Facility. Ada software foundations development will continue. The system support contractor begins verification and validation activities, and initiates development of the configuration management system.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The integration contractor will continue development and testing of the local area network (LAN), integrate the LAN with automated message handling, and begin deployment to the Operational Support Facility. Detailed joint mission application software design and coding efforts will increase significantly. A database management system will be selected and integrated with application software development effort. The common user contractor will complete the development (first release) of the automated message handling software, and development testing and evaluation will be performed. The system support contractor will continue verification and validation of WIS software. Specifications will be developed for the joint mission hardware. The cost estimate used for this program is a parametric preliminary estimate (cost category IV). The last comprehensive review of the estimate was made in July 1982. The draft baseline cost estimate is scheduled to be complete in January 1985. It will use additional data and more specific parameters for the WIS program.

(4) (U) Program to Completion: This is a continuing program. The integration and common user contractors will continue automated message handling software and local area network development and deployment to operational sites. Joint mission hardware, applications software, the software development and maintenance environment, and a data base management system will be deployed. Development work will include efforts on graphics-teleconferencing, simulation and analysis tools, further development of automated message handling capabilities, and joint mission applications software. Initial operational test and evaluation (IOT&E) will be conducted at operational sites.

C. (U) Major Milestones:

	Milestones		Dates
(1)	(U) Joint Mission Element Need Statement Published		February 1982
(2)	(U) Report to Congress on Modernization of WIS		July 1982
(3)	(U) Joint Operation Planning and Execution System and related Required Capabilities (ROC) Received		July 1983
(4)	(U) Automated Message Handling ROC Received		September 1983
(5)	(U) Integration Contract Awarded		October 1983
(6)	(U) Common User Contract Award	*(June 1984)	October 1984
(7)	(U) System Support Contract Award	*(July 1984)	February 1985
(8)	(U) Defense Systems Acquisition Review Council (DSARC) I/II		3rd Qtr/FY 1985
(9)	(U) Joint Mission Hardware Contract Award	*(June 1986)	1st Qtr/FY 1987
(10)	(U) Begin IOT&E of WIS	*(September 1986)	2nd Qtr/FY 1987
(11)	(U) Full Operating Capability		4th Qtr/FY 1990

* Date presented in Fiscal Year 1985 Descriptive Summary (program schedules will be baselined at DSARC I/II for block A capability and subsequent DSARC IIs for additional blocks).

(U) EXPLANATION OF MILESTONE CHANGES

(6) (U) Adjustment of Common User Contract award was caused by late receipt of user requirements/comments on the final proposal with a corresponding extension for vendors to respond and the complexity of contract source selection.
(7) (U) Award of the System Support Contract was delayed as the result of a change in procurement strategy to allow its award as a Small Business Program set-aside (8-A).
(9) (U) Award of the Joint Mission Hardware Contract was adjusted to coincide with design schedule of joint mission application and support software.
(10) (U) Start of IOT&E was rescheduled to coincide with Automated Message Handling software delivery from the Common User contract.

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): DT&E on the WWMCCS Information System (WIS) will be conducted according to the Test and Evaluation Master Plan (TEMP). The WIS Test Planning Working Group is preparing it for submission for Office of Secretary of Defense review prior to the Defense Systems Acquisition Review Council (DSARC) I/II milestone in the spring of 1985. The TEMP provides details on the DT&E for each of the WIS elements.

(U) The WIS is an evolutionary program. As each of its elements is developed, it will pass through DT&E and operational test and evaluation. As each element passes through the latter stages of testing--and later during its deployment--user feedback will be documented and (together with new user-defined requirements and new technology) will be used to plan and develop major enhancements. The enhanced elements will then pass through the same phases of testing. This iterative process will continue for the life of WIS and make its T&E an ongoing process.

(U) WIS is being implemented in a block approach which permits the system evolution to be divided into manageable portions. Three elements of Block A, which require developmental effort, are the local area network (LAN), the software development and maintenance environment (SDME) and software for the automated message handling (AMH) capability. The LAN and SDME will undergo DT&E from July 1986 - January 1987 and the AMH software will enter DT&E in November 1986. DT&E for successive blocks is scheduled to take place from 1987 through 1989. No DT&E reports have been issued.

(U) The WIS Joint Program Manager directs the Joint WIS program and tasks engineering development and acquisition activities to the WIS System Program Office. The Director, WIS System Program Office, Electronic Systems Division, chairs the Test Planning Working Group and is responsible for the management of DT&E. DT&E will be conducted at the Development and Evaluation Facility with the assistance of the Integration Contractor, its subcontractors, and associate contractors who will develop portions of the system. The facility was developed and will be operated by the System Program Office. The Integration Contract has been awarded to GTE and the Common User Contract to IBM. Additional contracts will be awarded later in the program.

2. (U) Operational Test and Evaluation (OT&E): To date, there have been no OT&E conducted and no OT&E reports issued on WIS. Block A OT&E is currently scheduled for early 1987. The detailed test schedule is to be determined. Test articles and other required resources are yet to be identified. Test scenarios are to be determined, but five candidate test sites have been identified.

(U) Responsible OT&E agencies. Air Force Operational Test and Evaluation Center is the lead OT&E agency for WIS. Supporting OT&E agencies are the Commander, Operational Test and Evaluation Force (Navy) and the Army Operational Test and Evaluation Agency. The Organization of the Joint Chiefs of Staff is represented by their Information Systems Division in OT&E planning.

3. (U) System Characteristics: The system's key operational and technical performance requirements are primarily based upon the WIS Operational and Information Requirements which were approved by the Joint Chiefs of Staff on

5 July 1983. These requirements are composed of the Joint Operation Planning and Execution System (JOPES) required operational capability (ROC) and the National Military Command System Information System ROC. These ROCs, in combination with others and the Joint Mission Element Need Statement for WIS, are being analyzed and have yielded the following preliminary characteristic categories:

PERFORMANCE	OBJECTIVES/THRESHOLDS	DEMONSTRATED
Response Time (priority) Simple Complex Security Useability Interoperability Software Portability	Thresholds will be determined at Defense Systems Acquisition and Review Council (DSARC) I/II in May 1985.	No tests conducted
READINESS/SUPPORTABILITY Availability/Reliability/Maintainability Mean Time Between Failure (MTBF) (Workstation/Printers) MTBF (WIS System)	Thresholds will be determined at DSARC I/II in May 1985	No tests conducted
FUNCTIONALITY Automated Message Handling Peak Message Received per Day Peak Message Received per Hour Peak Message Transmitted per Hour JOPES Course of Action Planning JOPES Detailed Planning Stringent Plan Development	Thresholds will be determined at DSARC I/II in May 1985	No tests conducted

NOTE: Block A is being defined in detail for a DSARC I/II milestone in Spring of 1985. Blocks B and C will add capabilities and will be defined in detail as the program progresses.

4. (U) Current Test and Evaluation. No development (DT&E) or operational test and evaluation (OT&E) under this program element has been done in the WIS Program for the past 12 months. No testing is scheduled for the next 12 months. Detailed planning for OT&E and DT&E will continue during 1985.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33601F
DOD Mission Area: # 333 - Strategic Communications

Title: Milstar Satellite Communications System (Air Force Terminals)
Budget Activity: # 3 - Strategic Programs

1. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		164,040	123,197*	132,095		Continuing	N/A
2487	Air Force Satellite Communications	164,040	123,197*	132,095		Continuing	N/A

*$4.0M will be reinstated due to a reprogramming source denial.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program consolidates the development and acquisition of AFSATCOM Ultra High Frequency (UHF) terminal modifications required for transition to the Milstar satellite system and provides resources for development/acquisition of Milstar Extremely High Frequency (EHF) terminals for the Air Force. The Milstar satellite system will provide a highly survivable, jam-resistant, worldwide, secure communications system to support the President and the military Commanders in Chief for command and control of the US strategic and tactical forces in all levels of conflict.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	Additional to Completion	Total Estimated Cost
RDT&E	177,552	141,592	114,801	Continuing	N/A
Missile Procurement	30,393	0	34,468	Continuing	N/A
Other Procurement (includes initial spares)	8,156	14,843	9,063	Continuing	N/A

(U) Explanation of funding differences:

A. (U) RDT&E: FY84 - $9,203 difference is the result of reprogramming by USAF to higher priority programs. $4,309 difference is the result of reprogramming funds not required by the Milstar planning effort to other high priority programs.

FY85 - $14,395 difference is the result of a FY85 RDT&E reduction by Congress.

PE #: 33601F

FY86 - $ 8,262 difference is the result of a Milstar zero base transfer from procurement funds to realign task assignments within the terminal program. $12,589 difference is the result of funds added to cover R&D for additional terminal design tasks.

B. (U) Other Procurement: FY86 - $9,063 deletion is the result of a zero base transfer to terminal R&D above.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
Funds	0	0	0	[ ]	Continuing	N/A
Quantities (Terminals)						
Missile Procurement						
Funds	30,400	0	34,384			
Quantities (Satellite Transponders)	1		1			
Other Procurement						
Funds (includes initial spares)	8,156	14,683	0		Continuing	N/A
Quantities (Terminal Modifications)	187	229				
Military Construction:						
Funds	0	0	0	[		]

5. (U) RELATED ACTIVITIES: Procurement of airborne AFSATCOM terminals/planned upgrades are funded in the weapons system programs. Approved Air Force users include the following PE's: PE 11113F, B-52; PE 11126F, B-1B; PE 28019F, RC-135; PE 11312F, EC-135; PE 11115F, FB-111; PE 32015F, E-4B; PE 27222F, KC-10A; and PE 11213F, Minuteman Missile Weapon System. The AFSATCOM program is also a supporting system of the Minimum Essential Emergency Communications Network (MEECN), PE 33131F. The Minuteman Intercontinental Ballistic Missile program integrates AFSATCOM satellite terminals into the launch control facilities. Additional users include the Navy TACAMO aircraft and the Army Nuclear Weapons Storage sites. PE 33603F, Milstar, will develop and acquire the spacecraft and mission control segments for this highly survivable, jam-resistant, worldwide command and control communications system. High risk development of advanced technology for the Milstar program such as travelling wave tube amplifiers (TWTA) and Extremely High Frequency (EHF) airborne antennas is funded in Advanced Space Communications, PE 63431F. PE 33110F, Defense Satellite Communications System (DSCS) funds host spacecraft and the single channel transponder for AFSATCOM. The Satellite Data System, PE 35158F, and the Navy Fleet Satellite Communications, PE 33109N are the major satellite systems hosting AFSATCOM transponders.

6. (U) WORK PERFORMED BY: The Air Force Satellite Communications System is managed by the Sacramento Air Logistics Center at McClellan AFB, CA, with minor residual terminal acquisition activities managed by Electronic Systems Division Hanscom AFB, MA and residual satellite activities managed by Space Division, Los Angeles AFS, CA. The transponders on the Satellite Data System are built by Hughes Aircraft Company, El Segundo, CA, and on the Fleet Satellite Communications System by TRW, Inc, Redondo Beach, CA. AFSATCOM Ultra High Frequency (UHF) terminal development was conducted by the Collins Telecommunications Products Division of Rockwell International, Cedar Rapids, IA, and the production was managed by Rockwell International, Newport Beach, CA. AFSATCOM system modems are produced by the Linkabit Corp, La Jolla, CA. The single channel transponders that are deployed on the Defense Satellite Communications System spacecraft were developed by General Electric, Valley Forge, PA. The ground-based terminal equipment used for communications through the single channel transponders is being produced by Stanford Telecommunications Inc., Sunnyvale, CA. Development and acquisition of terminal modifications for transition to Milstar and Milstar terminals being managed by the Electronics Systems Division, Hanscom AFB, MA. Selected terminal modifications are being developed and produced by Rockwell International, Santa Ana, CA, and Linkabit Corp, La Jolla, CA. Remaining AFSATCOM terminal modifications and the Air Force Milstar Extremely High Frequency (EHF) terminals are being developed in competition between the Raytheon Company, Sudbury, MA, and Hughes Aircraft Company, Fullerton, CA. Federal Contract Research Center support is provided by the MITRE Corporation, Bedford, MA and Lincoln Laboratory, Lexington, MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: # 2487, Air Force Satellite Communications (AFSATCOM) System

A. (U) Project Description: The Air Force Satellite Communications (AFSATCOM) program includes: (1) the remaining development tasks and operation and support of the current AFSATCOM UHF System, (2) upgrades to Air Force AFSATCOM UHF terminals for transition to the Milstar satellite system and (3) development/acquisition of Air Force Milstar EHF terminals. The AFSATCOM System is a satellite-based, operational, UHF system that provides command and control communications for the National Command Authority, the Joint Chiefs of Staff, Commanders in Chief of the US nuclear forces and other selected high priority users. The satellites used in the AFSATCOM system are multi-mission satellites and support other missions besides AFSATCOM. These non-dedicated satellites include Fleet Satellite Communications System satellites in geostationary orbits, Satellite Data System (SDS) satellites in highly inclined polar orbits, and other spacecraft. Together, these satellites provide communications for users in the entire northern hemisphere and to 70 degrees south latitude in the southern hemisphere. Terminals are installed in or are programmed for strategic bombers, airborne and ground command centers, Minuteman missile launch control centers, reconnaissance aircraft, nuclear weapons storage sites (Army funded) and in Navy aircraft (TACAMO) providing communications connectivity to the submarine fleet (Navy funded). Single channel transponders are being developed and produced to provide increased system survivability and will be installed on all Defense Satellite Communications System (DSCS III) satellites and SDS satellite F-6. Terminal upgrades are planned which will not only provide the means for a smooth transition to Milstar with minimal interruption in service to the operational users but will also enhance performance

in the presence of jamming and provide service to more users on existing channels. The Milstar satellite communications system will provide survivable, enduring, jam-resistant, worldwide and secure voice/data communications for the President, Joint Chiefs-of-Staff and the Commanders-in-Chief for the command and control of US strategic and tactical forces in all levels of conflict.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Installation of AFSATCOM terminals in strategic bomber and reconnaissance aircraft, missile launch control centers, and airborne/ground command centers was completed and Full Operational Capability (FOC) was achieved. Production of AFSATCOM system control and monitoring equipment continued; this hardware is required for more effective management of the various AFSATCOM networks and to identify unauthorized users. Development continued on the AFSATCOM terminal modifications required for transition to Milstar. These contracts will provide modifications to the AFSATCOM receiver/transmitter and modems for Milstar operation. The concept validation study that explored alternative approaches to providing Milstar Extremely High Frequency (EHF) communications capability in the missile launch control centers was completed. The design competition between the Raytheon Company, Sudbury, MA, and Hughes Aircraft Company, Fullerton, CA, for development of Air Force Milstar EHF terminals continued on schedule. Preliminary Design Reviews were successfully conducted with both contractors. The Invitation for Proposal (IFP) for Phase II of the terminal development effort was released to these contractors in September 1984.

(2) (U) FY 1985 Program: Development of selected AFSATCOM Ultra High Frequency (UHF) force element terminal modifications required for transition to Milstar will be completed and production contracts awarded in mid FY 85. Critical Design Reviews (CDR) for both the Milstar transition modifications to AFSATCOM Command Post terminals and Milstar EHF terminals will be conducted in February 1985. This will complete Phase I of the Air Force Milstar terminal development program. During Phase I (design competition) of Full Scale Development (FSD), two contractor leader-follower teams were in direct competition through Critical Design Review (CDR). During this period, each team exchanged sufficient technology and design information to insure a common design approach and the development of their (team) product strategy. As a requirement for CDR, each team will present proposals for Phase II (fabrication and test) of FSD. After evaluation, one team will be selected to continue development, fabrication and testing. Contract award is scheduled for May 1985. During Phase II of FSD, both leader and follower must demonstrate the capability to produce each Line Replaceable Unit (LRU), or terminal module, utilizing the common design approach mentioned above. A requirement during testing, and prior to production, is for the team to demonstrate that any combination of appropriate leader-follower LRUs may be assembled to form a working Milstar terminal. The purpose of this strategy is to develop dual product sources for Milstar terminal hardware to insure competition during production and thereby reduce costs. The preliminary design review for a Milstar terminal suitable for retrofit of the B-1B strategic bomber will be held concurrently with the critical design reviews. The schedule for this terminal lags the overall development schedule because of the technological challenges (e.g., space constraints, antenna radar cross-section requirements, etc.) involved in installing a Milstar EHF terminal in this airframe. In addition to the development tasks carried over from Phase I, Phase II will also include development of Milstar EHF terminal hardware required to meet the hardness/survivability

requirements of the missile launch control centers and will be carried out in accordance with the results of the concept validation effort mentioned above. Further concept validation studies will be initiated to explore alternative approaches to providing Milstar capability to directly support the President.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full Scale Development (FSD) of both Milstar Extremely High Frequency (EHF) terminals and the modifications to AFSATCOM Command Post terminals for transition to Milstar will continue. The Milstar Ultra High Frequency (UHF) transition terminal modifications will be fabricated, assembled and extensive in-plant testing will be initiated and design/fabrication of the associated Group A hardware will begin. Fabrication and assembly of initial EHF terminal hardware will be completed and in-plant testing will be initiated. Upon completion, integration of Milstar EHF development model terminals will begin on selected airborne platforms (e.g., EC-135, B-52) and at a ground Command Post site. The Critical Design Review for the B-1B EHF terminal will be completed in December 1986 and fabrication of this terminal hardware will begin. Development of the unique Milstar hardware required for the missile weapons systems (Peacekeeper and Minuteman Launch Control Centers) will continue [ ] The cost estimates for this program are the result of examining over 3000 Work Breakdown Structure elements. The estimates utilize modeling and engineering assessments, and include an allowance for risk.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones		Dates
(1) (U) AFSATCOM Initial Operational Capability Achieved		May 1979
(2) (U) Milstar Terminal Full Scale Development Start		September 1983
(3) (U) Full Operational Capability, AFSATCOM System	(* December 1983)	June 1984
(4) (U) EHF Terminal Preliminary Design Review	(* March 1984)	June 1984
(5) (U) EHF Terminal Critical Design Review		February 1985
(6) (U) Phase II FSD Contract Award	(* March 1985)	May 1985

* Date presented in Fiscal Year 1985 Descriptive Summary.

(U) EXPLANATION OF MILESTONE CHANGES

(3) AFSATCOM, Full Operational Capability was delayed six months by numerous minor manufacturing and test problems.

(4) EHF Terminal Preliminary Design Review slipped from March 1984 because contractor originally underestimated the complexity of the design task.

(6) Phase II FSD Contract Award slipped from March 1985 because program office underestimated complexity of source selection process.

Budget Activity: 3, Strategic Programs
Program Element: 33601F, Milstar Satellite Communications System (Air Force Terminals)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E):

(U) Air Force Satellite Communications (AFSATCOM) System. The Air Force Satellite Communications System terminals were developed by Rockwell International Corporation, Newport Beach, California. The service program manager is Electronic Systems Division (ESD). Development testing was conducted in-plant as part of initial operational testing and demonstrated that the technical performance of the system supported its intended use and confirmed expected theoretical performance. In addition, a single communications channel transponder (SCT) will be deployed on the Defense Satellite Communications System Phase III spacecraft as an evolutionary approach to improving the AFSATCOM. This single channel transponder and the associated ground transmission equipment were tested in each contractor's plan both separately and together demonstrating the technical compatibility of the ground and space segments.

(U) Milstar Terminals. The Air Force awarded Full Scale Development contracts for the first phase of Air Force terminal development in early September 1983 to the Raytheon Company, Sudbury, MA and the Hughes Aircraft Company, Fullerton, CA. Separate Critical Design Reviews (CDR's) for each of these contractors will be combined with source selection for the second phase of the development in the spring of 1985. Contract award to one of the two Phase I contractors is expected in May 1985. The Air Force Milstar Terminal Program Office at ESD has formed a Terminal Test Planning Working Group to coordinate test issues. System test plans arrived from the contractor in July and October 1984. Detailed test plans have also arrived for final analysis prior to CDR in February 1985. In-plant developmental testing will be accomplished with satellite simulators and field level developmental testing will begin as spacecraft become available. Development testing will transition to initial operational testing after checkout of the engineering development model terminals.

2. (U) Operational Test and Evaluation (OT&E):

(U) Air Force Satellite Communications System. The Air Force Satellite Communications (AFSATCOM) Initial Operational Test and Evaluation (IOT&E), managed by the Air Force Operational Test and Evaluation Center (AFOTEC) was combined with the Development Test and Evaluation (DT&E). The combined test and evaluation program began in February 1975 and IOT&E was concluded in September 1975. DT&E was extended to verify design fixes for identified equipment deficiencies.

(U) The IOT&E involved seven test sites (no ranges), six test aircraft, nine preproduction terminals, one satellite, and a satellite simulator. Airborne terminals were installed on operational and test aircraft. All four ground terminals were used in an operational configuration. Air Force personnel, trained either formally or by on-the-job training, operated the terminals to provide realistic operator/terminal interface evaluations. The number of operators used during any one test was the same as that expected during normal operational conditions for that terminal configuration. Trained operators were supplied by the Strategic Air Command (SAC), Military Airlift Command (MAC), Air Force Communications Command (AFCC), Electronic Security Command (ESC), 9th Airborne Command and Control Squadron (ACCS), and 6th ACCS. Contractor personnel were present to perform maintenance.

(U) Sixty-seven deficiencies identified during IOT&E were prioritized by the using commands and provided to the system program office (SPO) for resolution. The SPO addressed and officially closed sixty-six of these. The remaining deficiency is an electromagnetic compatibility (EMC) problem between the AFSATCOM terminal and other systems already onboard the B-52 aircraft.

(U) Follow-on operational test and evaluation (FOT&E) on the production terminals started in January 1980. AFOTEC conducted phases I and II of the FOT&E (verification of fixes for IOT&E deficiencies and wideband network performance) from January 1980 through June 1982. SAC conducted (AFOTEC monitored) phases III and IV (continued evaluation of operational effectiveness and suitability with continually increasing network complexity as more production terminals were fielded). Phases III and IV testing were completed in June 1983. The FOT&E was conducted using AFSATCOM transponders on the Satellite Data Systems (SDS) and the Fleet Satellite Communications (FLTSATCOM) operational satellites, production terminals (airborne and ground), and operational procedures developed by the using commands. The objectives were to evaluate performance in an operational environment and to verify reliability, maintainability, fixes to deficiencies, etc. The FOT&E used operational assets employed on normal training missions to the maximum practical extent. SAC was the primary participant in the test. The operational terminals were being operated and maintained by the appropriate using agency personnel.

Budget Activity: 3, Strategic Programs
Program Element: 33601F, Milstar Satellite Communication System (Air Force Terminals)

(U) The results of the Air Force Operational Test and Evaluation Center (AFOTEC) conducted phases I and II of the FOT&E revealed a number of deficiencies in both the operational effectiveness and operational suitability areas. Eight deficiencies were repeats of IOT&E deficiencies and had significant impact in the areas of hardware reliability, software effectiveness, technical data, and electromagnetic compatibility. The results of the SAC-conducted phases III and IV of the FOT&E revealed a total of 18 deficiencies in the same areas as above. Generally, however, AFSATCOM continues to successfully develop its capability for improved command, control and communications.

(U) HQ AFOTEC has published two reports on AFSATCOM OT&E: Final Report, Initial Operational Test and Evaluation (IOT&E), Air Force Satellite Communications AFSATCOM Systems, December 1975 (report classified Secret) and Air Force Satellite Communications (AFSATCOM) Systems Follow-on Operational Test and Evaluation Final Report, June 1982 (report classified Secret). HQ SAC published Air Force Satellite Communications Systems (AFSATCOM) Follow-on Operational Test and Evaluation (report classified Secret) for FOT&E phases III and IV in November 1984.

(U) The Single Channel Transponder (SCT) part of the AFSATCOM program is an Ultra High Frequency (UHF) and Super High Frequency (SHF) satellite communications system used for the transmission of the emergency action message (EAM) to the strategic forces. Per Air Staff direction, AFOTEC managed an Operational Utility Evaluation (OUE) of the SCT injection subsystem (SCTIS) which is an interface between the AFSATCOM ground network and the DSCS III ground terminals. The SCTIS testing was done without an orbiting SCT package. The OUE identified approximately 20 deficiencies in the fall of 1981. The biggest problems were technical data and poor interface design between SCTIS and the existing AFSATCOM equipment. The first SCT package was carried on the fall 1982 launch of DSCS III. By that time, the contractor had removed the SCTIS terminals to modify them for production. The first production terminals were delivered in June 1984. An SCT FOT&E will be conducted to ensure the OUE deficiencies were properly corrected.

(U) Milstar Terminals. The Milstar Air Force (AF) Terminal IOT&E, being managed by AFOTEC, will be combined with DT&E of the Milstar AF Terminals. The Air Force will conduct an incremental evaluation of the Milstar terminal's operational effectiveness and suitability as test assets become available (such as engineering development models, simulators, FLTSATCOM Extremely (high frequency) Package (FEP), and Milstar Satellites). The Milstar terminals will be evaluated during simulated and actual operation with Milstar satellites in realistic test scenarios. Selected Air Force terminal IOT&E results will be identified for inclusion in the Milstar multiservice IOT&E effort (program element 33603F).

(U) A limited IOT&E(1) test program is being conducted to support the February 1985 Critical Design Review (CDR) for the Milstar AF Terminal.

Budget Activity: 3, Strategic Programs
Program Element: 33601F, Milstar Satellite Communications System (Air Force Terminals)

Developmental hardware will not be available for IOT&E until after the CDR. The OT&E test team will form in early [ ] to initiate training and program familiarization for the formal IOT&E(2) efforts which begin in mid-[ ]

In addition to considerable ground and in-plant testing, a total of [ ] of IOT&E flight testing has been projected in EC-135 and B-52 aircraft. The Milstar IOT&E will conclude at the end of [ ] with the second Milstar satellite on-orbit and IOT&E completed using the first two satellites for cross-link testing.

3. System Characteristics:

AFSATCOM

Characteristics	Objectives	Demonstrated	Demonstrated By
Data rate (Words/Minute)	100	100	Operational Test
Error Rate	[ ]	[ ]	Operational Test
Anti-Jam Protection (decibel/watt)			
Air Force Satellite Communications System	[ ]	[ ]	Development Test
Single Channel Transponder			
Ultra High Frequency	[ ]	To Be Determined	Development Test
Super High Frequency	[ ]	To Be Determined	Development Test
Mean time between failure	100 to 1,000 hours depending on terminal configuration	Yes	Development Test

MILSTAR Terminals

Characteristics, thresholds, standards and goals for the IOT&E program have not yet been established.

Budget Activity: 3, Strategic Programs
Program Element: 33601F, Milstar Satellite Communications System (Air Force Terminals)

4. (U) Current Test and Evaluation (T&E):

AFSATCOM T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Publish FOT&E Phase IV Report	November 1984	same	Conducted by Hq SAC. HQ SAC reviewing final report for approval.

AFSATCOM T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
SCT FOT&E	FY 1985	Conducted by using Command

Milstar T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Complete IOT&E(1) Plan	February 1984	March 1984	
Complete Test Program Outline	October 1983	September 1984	

Milstar T&E Activity (Next 12 Months)

Continue test planning leading to publication of Milstar AF Terminal Test Approach in January 1985. Begin writing the test plan for AF Terminal testing.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33603F
DOD Mission Area: #333 - Strategic Communications

Title: Milstar Satellite Communications System
Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		148,409	325,042	345,696	390,199	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Milstar Satellite Communications System program is a Joint Service program to develop and acquire the new Milstar Extremely High Frequency (EHF) satellite and new or modified terminals. The Milstar system is being designed to meet the minimum essential wartime communications needs of the President and Commanders-in-Chief to command and control our strategic and tactical forces through all levels of conflict. It will also support other high priority users in crisis/contingency situations. The Air Force has total system development responsibility, heads the Joint Milstar Program Office and will manage the development and acquisiton of the space and mission control segments. Each Service will manage a terminal program (Air Force for airborne, Navy for shipborne and Army for ground) under the overall direction of the Milstar Joint Terminal Program Office managed by the Navy. This PE funds for development of the Milstar satellite and all mission control segments and procurement of Milstar satellites and Air Force mission control segments. Air Force Milstar terminal development and acquisition is funded in PE 33601F, Milstar Satellite Communications (Air Force Terminals).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	148,409	325,042	340,779		Continuing	N/A
Other Procurement			4,917		Continuing	N/A

FY86: The Other Procurement funds originally budgeted in FY 86 are for Development Test & Engineering/Initial Operational Test & Engineering test assets and should have been budgeted as RDT&E. This has been corrected.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds				43,100	Continuing	N/A
Quantities (Mission Control Elements)				5	Continuing	N/A
Other Procurement:						
Funds				34,720	Continuing	N/A
Quantities (Mission Control Elements)				5	Continuing	N/A

PE #: 33603F

5. (U) RELATED ACTIVITIES: The Milstar Program was initiated in FY 82 with funds in Advanced Space Communication (PE 63431F) and Air Force Satellite Communications System (AFSATCOM) (PE 33601F). The Milstar Satellite Communications System (PE 33603F) was created in the FY 83 President's Budget submission and contained both satellite and terminal development funds. However, beginning in FY 84, Air Force Extremely High Frequency (EHF) terminal development and procurement is funded in Milstar Satellite Communications (Air Force Terminals) (PE 33601F), formerly AFSATCOM, and the Milstar satellite and mission control segment development and procurement programs are funded in Milstar (PE 33603F). This is consistent with all other DoD Satellite Communications (SATCOM) development and production programs. In addition to developing the new Milstar satellite, the Air Force is also managing the development and acquisition of the EHF applique packages for Fleet Satellite Communications (FLTSATCOM) vehicles F-7 and F-8 which are funded in the Navy's EHF SATCOM (PE 64577N). Acquisition of the Centaur upper stage and launch support is funded in Space Launch Support (PE 35171F). High risk technology development for Block II and follow-on versions of Milstar are funded in Advanced Space Communication (PE 63431F). The Army and Navy terminals are funded under Satellite Communications Ground Environment (PE 33142A) and Extremely High Frequency Satellite Communications (PE 64577N) respectively. Air Force Ground Mobile Forces (GMF) terminals are being funded under Satellite Communications Terminals (PE 33605F). Development of a Complementary Expendable Launch Vehicle is funded in Space Boosters (PE 35119F).

6. (U) WORK PERFORMED BY: The development of the Milstar satellite and the mission control segment of the Milstar system is being managed by the Air Force Systems Command's Space Division, Los Angeles AFS, CA. The contract for the Full Scale Development of the Milstar satellite and mission control segment was awarded on 30 June 1983. The prime contractor is Lockheed Missile & Space Co., Sunnyvale, CA. Subcontractors to Lockheed include: Hughes Aircraft Co., El Segundo, CA; TRW, Inc., Redondo Beach, CA; General Electric Co., Valley Forge, PA; and Raytheon Co., Sudbury, MA. Hughes is responsible for the crosslink and frequency and time standards subsystems; TRW for the payload subsystem; and General Electric for portions of the data handling subsystem.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 33603F, Milstar Satellite Communications System

A. Project Description: This program will design, fabricate, test and acquire the new Milstar EHF satellite consisting of the mainframe (or "bus"), the communications payload, antenna suite [ ] and the satellite mission control segment. The system will incorporate state-of-the-art techniques for jam resistance and physical survivability. Key features are higher frequencies, bandspreading, on-board signal processing, end-to-end encryption, nulling antennas, hardening (both nuclear and laser), [ ] a high degree of autonomy and on-orbit storage. A special endurance feature of Milstar is the mission control segment which will allow selected command terminals located on survivable platforms to control the satellite/system. A small ultra high frequency (UHF) package will provide backward compatibility with existing UHF systems and facilitate the transition to EHF. This program will provide the required worldwide, two-way, jam-resistant secure, highly survivable and enduring communication capability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: System level engineering tasks begun in FY 1983 were continued; satellite subsystem Preliminary Design Reviews were started and the mission control segment System Design Review was conducted. Breadboard build up and tests of critical portions of the satellite design were begun and will continue through FY 1985. Ordering of piece parts was started.

(2) (U) FY 1985 Program: The primary effort will be to continue detailed design work and complete the satellite communication payload and subsystem Preliminary Design Reviews (PDRs) and the Block I satellite system PDR. Major emphasis will be placed on detailed planning for integration of the payload into the satellite bus. Plans also call for starting an advance buy for the first Development Flight Satellite #1 (DFS-1) and mission control element development models.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The primary effort will be to continue detailed design work leading to communication payload, satellite subsystem, Block I satellite system, and mission control segment Critical Design Reviews(CDRs). Major emphasis will be placed on detailed planning for mating the satellite with the Centaur upper stage and integrating the complete spacecraft and upper stage into the Space Shuttle. This includes development of system level end-to-end test plans. Development work will begin on the Block II design after completion of the various Block I payload and subsystem CDRs. Block II is planned for implementation on DFS-4. Cost estimates are based on current contract awards. In addition, an Independent Cost Analysis for the satellite and mission control segment has been completed. The Block II Milstar is a candidate for launch by the Complementary Expendable Launch Vehicle (CELV).

(4) Program to Completion: This is a continuing program. Development work will continue on the satellite and mission control segments with launch of the first Development Flight Satellite (DFS-1) scheduled for [ ] Development satellites two through five are scheduled for [ ] Satellite production, commencing with satellite number six, is scheduled to begin in [ ] Production of both airborne and ground mission control elements is scheduled to begin in [ ] with installations starting in [ ]

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Program Start		April 1981
(2)	(U)	Concept Validation Phase		March 1982
(3)	(U)	Full Scale Development Contract Award		June 1983
(4)	(U)	Block I Payload Preliminary Design Review	*(June 1984)	July 1984
(5)	(U)	Block I Satellite Preliminary Design Review		October 1985
(6)		Start Fabrication of Block I Development Flight Vehicle #1		[ ]

(7) (U)	Start Block II Satellite Full Scale Development	January 1986
(8) (U)	Block I Stellite Critical Design Review	September 1986
(9)	Launch of Block I Development Flight Vehicle #1	

* Date presented in Fiscal Year 1985 Descriptive Summary.

(U) EXPLANATION OF MILESTONE CHANGES

(4) (U) This change results from a minor replanning of the program schedule.

(9) (U) Date of first launch was changed to reflect prime contractor and program office estimate of what was achievable with a reasonable amount of risk. This date will be reevaluated periodically to insure that it remains realistic.

Budget Activity: 3, Strategic Programs
Program Element: 33603F, Milstar

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The full scale development contract was awarded in FY 83 and DT&E has started on several of the segments that comprise the Milstar Satellite Communications System.

(U) Test Schedule

Part/Circuit/Box Level Survivability Tests: FY 84/

Interface Tests - Satellite to Terminal:
- Payload Simulator to Terminal
- Mission Control Segment to Satellite
- Mission Control Segment to Terminal:

System Level End-to-End Tests (Performance, Survivability, Interoperability):

On-Orbit Tests

(U) The Milstar program manager is located in the Joint Milstar Program Office, Space Division (Air Force Systems Command). Lockheed Missiles and Space Company, Sunnyvale, California, is under contract to Space Division for the general systems engineering and the satellite and mission control segments. Space Division is responsible for the system level, satellite, and mission control segment DT&E.

(U) The terminal developments are coordinated by the program manager in the Milstar Joint Terminal Program Office, Naval Electronics Systems Command (NAVELEX). The submarine and ship terminal developments are done by the Navy Extremely High Frequency Satellite Program, NAVELEX. NAVELEX has two competing full scale development contractors: Raytheon Company, Sudbury, Massachusetts and Harris Corporation, Melbourne, Florida. The Army Satellite Communications Agency (SATCOMA) will develop the ground terminals. The ground terminal contractors will be selected in FY 85. The airborne terminals will be developed by Electronic Systems Division (Air Force Systems Command). Two competing full scale development contractors have been selected: Raytheon Company, Sudbury, Massachusetts and Hughes Aircraft Company, Fullerton, California. Each terminal acquisition agency is responsible for their terminal's DT&E program.

2. (U) Operational Test and Evaluation (OT&E): (See also Program Element 33601F, Milstar Satellite Communications (Air Force Terminals).)

(U) Responsible Organizations. The Air Force Operational Test and Evaluation Center (AFOTEC) has been designated the lead agency for conducting a multiservice IOT&E program for the overall Milstar system. The Army's Operational Test and Evaluation Agency (OTEA), the Navy's Operational Test and Evaluation Force (COMOPTEVFOR), and the Marine Corps Operational Test and Evaluation Agency (MCOTEA) will participate in the multiservice IOT&E which will take place as a

combined DT&E/IOT&E effort. A multiservice test team will be formed with representatives from Air Force, Army, Navy, Marine Corps, and the Defense Nuclear Agency (DNA) to conduct the IOT&E testing.

(U) Test Approach. Testing will occur incrementally as test assets become available, i.e., engineering development models, simulators, the Navy FLTSAT extremely high frequency package, production items, and Milstar satellites one and two. Each test increment will address those objectives or subobjectives which can be tested with the test assets available. At the completion of each test increment, the multiservice test team will present a factual report. Each participating OT&E agency will then publish an independent evaluation report in its own format and will process that report through its normal service channels. At the completion of testing, a final factual data report and final independent evaluation reports will be prepared following the procedure outlined above. In addition to the multiservice IOT&E program, the services will be conducting independent testing under their respective terminal development programs.

(U) Test Planning. AFOTEC is presently accomplishing early planning for IOT&E.

(1) (U) The critical issues and objectives and subobjectives have been prepared and are presently being coordinated with the Army, Navy, and Marine Corps.

(2) (U) The Testing Planning Outline (TPO) for IOT&E(1) and IOT&E(2) has been prepared which includes resources from Army, Navy, and Marine Corps to support the multiservice test efforts.

(3) (U) AFOTEC is performing an IOT&E(1) analysis and modeling effort to provide an operational input into the critical design reviews which take place over the next 24 months.

Planned IOT&E(2). The IOT&E(2) will commence in early [ ] and continue through testing with the second Milstar satellite on-orbit. Particular emphasis will be placed on conducting terminal interoperability testing (terminals from all three services) in realistic environments to evaluate Milstar system connectivity. Key events are:

(1) Commence Forming Test Team - [ ]

(2) (U) Publish Milstar Multiservice IOT&E Test Plan - Dec 86

(3) First Test Event - [ ]

(4) Complete Final Test Event - [ ]

(5) Final Test Report and Briefings - [ ]

(6) Dissolve Test Team - [ ]

Budget Activity: 3, Strategic Programs
Program Element: 33603F, Milstar

3. (U) Systems Characteristics:

(U) MISSION AND DESCRIPTION: The Milstar Satellite Communications System will provide a new generation communications system to meet the projected minimum essential wartime operational requirements associated with military communications. The program objective is to develop and deploy an affordable terminal and satellite system that is survivable, jam-resistant, and has a low probability of intercept in order to meet strategic, tactical, and other associated communication needs. Submarines, ships, aircraft, and mobile and fixed ground installations are projected to be equipped with Milstar terminals.

(U) Characteristic	Objective/Threshold	Demonstrated
(U) Survivability		
Jam Resistant	[ ]	Future Tests Future Tests
Low Probability of Intercept	[ ] (circular equivalent vulnerability radius)	Future Tests
Nuclear Scintillation	[ ]	Future Tests
(U) Performance		
Capacity	Nominally [ ]	Future Tests
	Nominally [ ]	Future Tests
Constellation Time Control	[ ]	
Constellation Ephemeris Control	[ ]	Future Tests

Budget Activity: 3, Strategic Programs
Program Element: 33603F, Milstar

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Complete Test Approach	Feb 84	Feb 84	
Complete IOT&E(1) Plan	Feb 84	Mar 84	
Complete Test Program Outline	Oct 83	Sep 84	

T&E Activity (Next 12 Months)

Event	Planned Activity	Remarks
Revise Milstar System Test Approach.		As needed.
Begin writing test plan for Milstar Multiservice IOT&E.		Will be published by Dec 86

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35155F Title: Theater Nuclear Weapon Storage and Security System
DOD Mission Area: #205 - Physical Security Systems Budget Activity: #3 - Strategic Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,153	1,958	1,045	-0-	-0-	5,156

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Tactical Air Forces identified a requirement for an improved method to store nuclear weapons to enhance survivability, security and safety. This need was documented in Tactical Air Forces Statement of Operational Need 303-79. The Theater Nuclear Weapon Storage and Security System (WS^3) satisfies this need. This system provides unmanned, underground storage of nuclear weapons [ ] Survivability, in the face of a Warsaw Pact conventional attack, is greatly enhanced by the hardening, dispersal, and masking of intelligence signatures provided by the system. Operational readiness is increased by [ ] With the increasing threat of terrorist attack, security is enhanced by the increase in access denial time of [ ] minimum and the greatly reduced need to [ ]

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,153	1,958	1,972		-0-	6,083
Other Procurement	-0-	-0-	-0-		96,900	96,900

(U) Program was repriced based on more refined data, Initial Operational Capability was accelerated 14 months, and quantity was increased to provide protection for U.S. weapons deployed at non-U.S. sites. Result was a $31.1 million reduction in cost.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	- 0-	-0-	2,944	20,924	85,617	109,485
Quantities	0	0	4	72	265	341
Military Construction:						
Funds	-0-	-0-	-0-	800	66,648	67,448

5. (U) RELATED ACTIVITIES: Exploratory development on the storage vault segment was conducted by Defense Nuclear Agency under PE 62715M, Project A99QAXFC-304, Weapon Storage Vault. Aircraft shelter sensors being procured under PE 27589F, Base Physical Security Systems will be integrated into the Weapon Storage and Security System command, control, and communication (C^3) segment.

6. (U) WORK PERFORMED BY: Sandia National Laboratory, Albuquerque, NM is conducting full scale development. Electronic Systems Division, Hanscom AFB, MA has program management responsibility for the Weapon Storage and Security System.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 35155F, Weapon Storage And Security System

A. (U) Project Description: Continues development of the Weapon Storage and Security System and procures and installs 341 storage vaults at eight United States Air Forces, Europe main operating bases and twelve non-U.S. NATO sites.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: An FY 1984 new start, full scale development was initiated to complete development of the vault segment, integrate command, control, and communication segment, and complete preproduction engineering tasks. Specific efforts accomplished were an independent cost analysis, final configuration definition, and test planning initiation.

(2) (U) FY 1985 Program: Development continues. Preliminary and Critical Design Reviews are accomplished; detailed design of the vault and command, control, and communication segment is initiated; testing begins; and site surveys are completed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full scale development and testing are completed. Final detailed design of the vault and command, control and communication segment is completed. Production begins. Estimated program costs are based on an independent cost analysis completed in March 1984 and are considered to be Category III, Budgetary. Competitive, fixed price contracts for production and installation were assumed.

(4) (U) Program to Completion: Production continues. Installation begins in FY 1987 and is completed in FY 1991.

C. (U) Major Milestones:

Milestones		Dates
(1) (U) Development Start	*(December 1983)	February 1984
(2) (U) Development/Initial Operational Test and Evaluation	*(November 1985)	August 1986
(3) (U) Production Decision	*(September 1986)	February 1986
(4) (U) Start Installation	*(June 1988)	June 1987
(5) (U) Initial Operational Capability (IOC)	*(June 1989)	May 1938
(6) (U) Installation Complete		September 1991

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) EXPLANATION OF MILESTONE CHANGES

(1) (U) Development start slipped because of late release of FY 1984 funds.
(2) (U) Testing of the vault segment is completed in November 1985, completion of full system testing slipped because of alarm annunciator console availability.
(3)-(5) (U) Program restructured to accelerate IOC by 14 months.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63230F
DOD Mission Area: #221 - Counter Air

Title: Advanced Tactical Fighter (ATF)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING: ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		34,125	94,287	242,852	262,736	TBD	TBD
2472	Advanced Tactical Fighter	5,125	14,700	53,000	53,000	TBD	TBD
2878	Joint Advanced Fighter Engine	29,000	74,600	149,852	172,336	339,000	780,698
2995	Critical Subsystems Development	0	4,987	40,000	37,400	64,220	146,607

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Tactical Fighter (ATF) program will develop the next generation air superiority tactical fighter aircraft. A new generation of fighters will be needed in the early 1990s to keep pace with threat improvements and expanding mission needs and to achieve greater efficiency in overall systems operation. Because of the long lead times necessary to develop and field new aircraft (traditionally 10-12 years), we must maintain a concerted effort to develop and mature the concepts and technologies that will be responsive to tactical needs of the 1990s. The Advanced Tactical Fighter program includes initial development and demonstration of an advanced technology engine that began in FY 1983.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	34,650	94,287	249,830		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The Advanced Tactical Fighter program is related to the Advanced Fighter Technology Integration (AFTI) program (PE 63245F) which will develop integrated avionics suites, digital flight controls and aerodynamic refinements to meet the need of the next generation fighters. This program is currently modifying an F-16 with a highly integrated flight/fire control system to develop greater capability and survivability in unguided weapons delivery and air-to-air combat. Using an F-15, this program will also demonstrate an advanced two dimensional thrust vectoring/reversing engine nozzle and integrated flight and propulsion control to enhance maneuvering performance and effective short takeoff and landing capability. Advanced development for the ATF flight simulator is funded in PE 64227F, Flight Simulator Development, starting in FY 87.

6. (U) WORK PERFORMED BY: Technology and concept definition studies are being managed by the Air Force Systems Command/Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Contracts for concept definition studies were awarded to seven major airframe contractors on 2 Sep 83. Contractors for the FY 1983/FY 1984 studies were Boeing Aerospace Corp, Seattle, WA; General Dynamics Corp, Fort Worth, TX; Grumman Aircraft Company, Bethpage, NY; Lockheed California Company, Burbank, CA; McDonnell Aircraft Company, St Louis, MO; Northrop Corp, Hawthorne, CA; and Rockwell International, Los Angeles, CA. The advanced engine development is being managed by the Air Force Systems Command/ Wright Aeronautical Laboratories and Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Contracts for advanced engine development were awarded to Pratt and Whitney Aircraft Group of West Palm Beach, FL, and the General Electric Co, of Evendale, OH, on 30 Sep 83.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2472, Advanced Tactical Fighter

A. (U) Project Description: The Advanced Tactical Fighter project will develop the next generation air superiority fighter aircraft design leading to a full-scale development decision in FY 1989 and operational capability in FY 1995. The ATF will be required by the early 1990s to counter two new generations of Soviet fighters that will have maneuvering capability and fire control systems equivalent to or better than our most advanced F-15/F-16s. The increased possibility of operations in areas like Southwest Asia emphasizes the need for greater combat radius, more rapid deployment capability, and reduced logistics support than can be achieved by current fighters.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: FY 1984 activity completed the contractor Concept Development Investigation (CDI) studies which were initiated at the end of FY 1983. The Ai Force will conduct a thorough evaluation phase during which a preferred ATF concept will be selected for further design maturation during a competitive Demonstration and Validation phase.

(2) (U) FY 1985 Program: During FY 1985, three contractors/teams will be selected to demonstrate/validate their ATF concept through detailed design analysis and testing, mission effectiveness analysis, and wind tunnel testing. This early phase of the demonstration/validation program will require extensive computer and design trade-off analyses, computer simulations of design concepts versus the threat, and preliminary force interaction and force structure analyses. A comparison to the level of effort expended on the F-15 program prior to the start of full-scale engineering development was used as the basis of the demonstration/validation cost estimate for the ATF project. Planning estimates for the ATF project were developed by the ATF Systems Program Office and updated to support the Milestone I Requirements Review.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 Request: The FY 1986 funding will continue the design concepts demonstration/validation efforts leading to a Systems Requirements Review in mid-FY 86. This review will present the initial contractor proposed System Specification and is the first phase of the requirements process. Through the remainder of this year, efforts will be concentrated on preliminary design and validation of major sub-elements of the ATF system. Category IV program estimates are based on preliminary planning data.

(4) (U) Program to Completion: (U) The program Demonstration and Validation phase will continue into FY 1989 when a single ATF design will be selected for Full-Scale Development. The funding request for FY 1989 applies to transition of the program to a PE 64239F, Advanced Tactical Fighter, and includes cost for detailed design, tooling and fabrication of the initial ATF Full Scale Development (FSD) aircraft. It is expected that 12 development aircraft will be constructed.

C. (U) Major Milestones:

	Milestones	Dates
(1)	Mission Element Need Statement approved by Defense Resources Board	November 1981
(2)	Technology and Concept Development Contract Awards	September 1983
(3)	Milestone I (Requirements Review)	FY 1985
(4)	Milestone II (Full-Scale Development Decision)	FY 1989
(5)	Milestone III (Production Decision)	FY 1991
(6)	Initial Operational Capability	FY 1995

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2878, Joint Advanced Fighter Engine

A. (U) Project Description: The advances in propulsion technology sought in the Joint Advanced Fighter Engine development will be essential to achieving the significant capability improvements needed in the next generation fighter. The Joint Advanced Fighter Engine project will develop new engine design concepts and technologies appropriate for application to the Air Force and, possibly Navy, fighter requirements. The JAFE project funds a competitive prototype engine demonstration of two advanced engine designs suitable for transition to FSD in FY 1989.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The funding request for FY 1984 continued engine design tasks in preparation for a demonstration and validation of the advanced engine design concepts, materials, and manufacturing processes which will be incorporated in the ATF engine at FSD.

(2) (U) FY 1985 Program: The funding for FY 1985 will complete engine design and initiate the fabrication of critical engine components. The engine components will be demonstrated through intensive testing on partial engine rigs and further integrated on slave engine test stands. FY 1985 will be a very manpower intensive period of engineering design work, design tradeoffs and technology developments. Cost estimates for the engine project were based on analogies to the F100 Initial Engine Development Program (IEDP), detailed grass roots estimates, other advanced development programs and FY 1982 competitive contractor estimates. Budgetary cost estimates for the ATF engine program were updated by the ATF Systems Program Office to support the Milestone I Requirements Review.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The funding for FY 1986 will complete the fabrication of demonstration engines and initiate durability and performance demonstration of these engines. Preliminary system requirements information from the ATF project (2472) will be used to initiate any specification revisions to basic design parameters. Costs are based on negotiated Firm Fixed Price increments on two competitively awarded contracts(Category III).

(4) (U) Program to Completion: The FY 1986-FY 1989 program will complete the competitive prototype engine demonstrator project for transition to Full-Scale Development with the Advanced Tactical Fighter airframe design. Engine systems validation will be accomplished through extensive performance, durability and operability testing of engine cores and prototype propulsion systems configured specifically for tactical fighter application. This project will result in a much more mature engine design than achieved with the F100 Initial Engine Development Program for reduced risk transition to Full-Scale Development in FY 1989.

C. (U) Major Milestones: The relevant milestones for the Joint Advanced Fighter Engine project are the same as those shown for the Advanced Tactical Fighter project.

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2995, Critical Subsystems Development (CSD)

A. (U) Project Description: The purpose of this project is to demonstrate that those technologies critical to the development of the ATF can be successfully integrated into an effective system. Several critical technologies in the areas of advanced integrated avionics, Very High Speed Integrated Circuits (VHSIC), weapons integration, low observables, and advanced radar/sensor development must be matured prior to aircraft design freeze. This project will begin in FY 1985 and be completed in time to support a Full-Scale Development decision during FY 1989.

B. (U) Program Accomplishments and Future efforts:

(1) (U) FY 1984 Accomplishments: This project is an FY 85 New Start. A Critical Technology Demonstration study was funded during FY 1984 by the Air Force laboratories at Wright-Patterson AFB and the ATF project (2472). The same seven airframe manufacturers conducting the ATF Concept Development Investigation (CDI) participated in this study to identify the key high risk technologies that must be matured prior to FSD of the ATF. The contractors were also to

propose the most cost effective technical approach to reducing risk on those technologies considered critical to the ATF design.

(2) (U) FY 1985 Program: Based upon the FY 1984 Critical Technology Demonstration study results, specific areas for concentration of technology development to reduce risk for FSD have been identified. Funding for FY 1985 will initiate action on development and demonstration of Integrated Avionics Architecture, insertion of Very High Speed Integrated Circuit (VHSIC) technology into processors and computers for the Integrated Avionics Architecture, development and demonstration of an advanced fire control radar/sensor suite for fighter missions, and improvement in the carriage density of the Advanced Medium Range Air-to-Air Missile (AMRAAM) system. Initially, studies will be conducted in each area to define the specific approaches to be taken in the later design and demonstration stages. Computer simulation and modeling/wind tunnel evaluations will be conducted to refine the radar/sensor suite concepts and requirements and to determine a viable approach for flight test on modified AMRAAMs.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 Request: The FY 1986 Critical Subsystems effort will complete the study stage and initiate design and fabrication of demonstration brassboard and ground based laboratory hardware for VHSIC insertion and Integrated Avionics Architecture. Competitive contracts will be awarded for radar and sensor suite for the ATF. Additionally, hardware fabrication and testbed modification will begin for the AMRAAM carriage density improvement. Category IV cost estimates are based on preliminary planning data.

(4) (U) Program to Completion: The FY 1987-1989 programs will complete the demonstration of an Integrated Avionics Architecture which will insert VHSIC into such components as a common signal processor and a MIL-STD-1750A computer; show the feasibility of integrating several subsystems such as the Integrated Electronic Warfare System (INEWS), the Integrated Inertial Reference Assembly (IIRA) and the Integrated Communications Navigation Identification Avionics (ICNIA) and the Advanced Radar/Sensor Suite; and demonstrate sensor fusion for the ATF.

C. (U) Major Milestones: The relevant milestones for the Critical Subsystems Development project are the same as those shown for the Advanced Tactical Fighter project.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63239F   Title: Advanced Tactical Air Reconnaissance System
DOD Mission Area: #327 - TIARA for Tactical Air Warfare   Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	1,500	20,339	74,619	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Tactical Air Reconnaissance System (ATARS) is an advanced development program to meet the needs of tactical commanders for detection, location and classification of tactical targets with sufficient location accuracy and detail to permit the timely delivery of appropriate air or ground launched weapons. The ATARS Mission Element Need Statement (MENS), May 1981 and the corresponding Justification for Major System New Start (JMSNS), as approved by the Office of the Secretary of Defense (OSD) in Aug 1982, identify the requirement for near-real-time (NRT) intelligence information. These requirements will be met by a mix of tactical reconnaissance platforms including standoff and penetrating manned and unmanned vehicles. This Program Element will focus on the validation of employing electro-optical imagery sensors in a pod for application on tactical aircraft and in unmanned vehicles. This program will also investigate the contribution of unmanned vehicles to the tactical reconnaissance mission.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	0	3,735	6,898		Continuing	N/A

FY 1985 funding was reduced by Congress. The FY 1986 estimate was changed to provide sufficient resources to evaluate manned and unmanned concepts for reconnaissance vehicles.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The Advanced Tactical Air Reconnaissance System (ATARS) will assume control of the concept validation effort started in Program Element 64710F, Reconnaissance Equipment, project 2337, Advanced Reconnaissance Sensor (ADRES). Imagery exploitation equipment developments will be coordinated with developments in Program Element 27435F, Tactical Reconnaissance And Imagery Exloitation. Sensor developments conducted under Program Element 63208F. Reconnaissance Sensors/Processing Technology, will support sensor definition and desig- Vehicle

concepts will be evaluated in conjunction with the Navy reconnaissance efforts conducted under Program Element 63261N, Tactical Reconnaissance.

6. (U) WORK PERFORMED BY: The Aeronautical Systems Division, Wright-Patterson AFB, OH has overall management responsibility for system evaluations and study efforts. Coordination with Electronic Systems Division, Hanscom AFB, MA, and Rome Air Development Center, Griffiss AFB, NY will be maintained to ensure consideration of ground processing and exploitation equipment requirements. General Dynamics, Ft Worth, Texas will be the prime contractor for sensor integration and flight demonstration using an F-16. Sensor evaluations on unmanned vehicles will be performed using Navy platforms.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63239F, Advanced Tactical Air Reconnaissance System

A. (U) Project Description: This project will evaluate electro-optical imagery sensors compatible with manned and unmanned vehicles for future reconnaissance applications. Current technology sensors and a digital recording/data link capability will be designed for integration into a pod and flown on an F-16. A missionized rear cockpit for in-flight review of sensor imagery will be evaluated. An existing ground exploitation system will be modified to investigate air/ground interfaces. Sensor integration will be designed for configuring a Navy unmanned vehicle.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: A concept validation phase was initiated in PE 64710F, Reconnaissance Equipment, to design a sensor pod for use on tactical aircraft. This program included definitization of hardware requirements for electro-optical sensors, and evaluation of man-machine interface for in-flight imagery review.

(2) (U) FY 1985 Program: The concept validation phase will continue entirely in Program Element 63239F and include the design of electro-optical sensors compatible with the pod and recoverable unmanned vehicles. In addition a cockpit simulator will evaluate crew coordination and workload in a dynamic operational environment. The flight simulation program will validate crew/vehicle interface for on-board review of imagery. A flush mounted sensor pod will be built and evaluated in a flight test using existing cameras to determine airflow characteristics and sensor performance in the high-speed, low-altitude environment.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Concept validation of the electro-optical sensors will be continued and a flight demonstration using an F-16 configured with a sensor pod will be conducted. The following concepts will be evaluated: effectiveness of electro-optical imagery in the low-altitude,

high-speed regime; a rear cockpit sensor management/image display and exploitation system; sensor/air frame interfaces; air-to-ground data link; and definition of ground station capabilities. In addition, cost/performance trade-offs will be analyzed to support a decision on whether the unmanned vehicle should be recoverable or expendable. Initial sensor evaluations will be accomplished using a recoverable system. Costs are category IV, and are based on preliminary analysis by the program office.

(4) (U) Program to Completion: A decision to proceed with Full Scale Development (FSD) will be made based on the results of the concept validation phase. FSD is planned for initiation in FY 1987. Sensors will be fabricated and operational testing will be accomplished on the selected vehicles and ground segment. This will permit engineering changes to be incorporated into production lines during the 1990s.

C. (U) Major Milestones:

	Milestones	Dates
(1)	(U) Advanced Tactical Air Reconnaissance System (ATARS) Mission Element Need Statement (MENS)	May 1981
(2)	(U) Justification for a Major System New Start (JMSNS)	August 1982
(3)	(U) Concept Validation	September 1984
(4)	(U) Flight Demonstration	July 1986
(5)	(U) FSD Initiation	October 1986
(6)	(U) Flight Test Start	August 1988
(7)	(U) Production Decision	June 1989
(8)	Initial Operational Capability	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63256F
DOD Mission Area: #265 - Intratheater Airlift

Title: Joint Services Advanced Vertical Lift Aircraft (JVX)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	1,086	4,901	5,000	TBD	TBD
2973	AF Unique Development	0	1,086	4,901	5,000	TBD	TBD

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The JVX will provide the Navy, Air Force, Army and Marine Corps with the ability to conduct combat, combat support and combat service support missions requiring vertical/short takeoff and landing (VSTOL) capabilities. JVX will replace a number of aging, obsolescent aircraft no longer capable of adequately performing their assigned missions and will also provide expanded mission capabilities. In the 1990's and beyond, the JVX will complement the capability of the USAF Special Operations Force (SOF) MC-130E/H aircraft. While the Navy is funding the airframe and engine development, Air Force funding is for development and integration of systems unique to the SOF mission.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	0	1,086	9,542		43,100	53,728

(U) FY 1985 Descriptive Summary was based on the Air Force funding only its unique systems development. The $55.2 million was supported by the Office of the Secretary of Defense, Cost Analysis Improvement Group as the minimum required for our unique development requirements. Since the preliminary design was only half complete during our FY 86-90 POM, this funding could not be justified, and reduction to $5 million per year resulted.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
Funds	0	0	0	0	TBD	TBD
Quantities	0	0	0	0	80	80

5. (U) RELATED ACTIVITIES: Development of a multi-mode radar with possible future application for JVX low level, hostile threat, adverse weather operations is being pursued in PE 63203F, Advanced Avionics for Aircraft and will transition to PE 64219F, Integrated Digital Avionics in FY 1986.

6. (U) WORK PERFORMED BY: The team of Bell-Textron (Arlington, TX) and Boeing Vertol (Ridley Park, PA) was selected in April 1983 to perform the preliminary design of JVX. The principal RDT&E agency is Naval Air Systems Command (NAVAIRSYSCOM). Numerous agencies from the Joint Services will participate.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2973, AF Unique Development

A. (U) Project Description: See paragraph 2.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable.

(2) (U) FY 1985 Program: The Air Force is working with the Navy program office to define the baseline JVX. When this is completed, service unique systems can be defined. Expected activities include definition of avionics architecture and any new systems development requirements, development of a military standard (MIL-STD) 1750A instruction set, and initiation of logistics and electronic warfare studies applicable to the JVX use in the Special Operations Force (SOF) mission. In addition, the Cost and Operational Effectiveness Analysis conducted on the SOF mission will be extended to cover secondary missions such as combat rescue, intratheater airlift, and others.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: MIL-STD 1750A instruction set development and the two studies begun in FY 1985 will be completed in FY 1986. SOF equipment will be procured and integrated in preparation for testing in FY 1988. Activities will be initiated to support dynamic simulation of crew station tasks extremely essential to the successful completion of the SOF mission.

(4) (U) Program to Completion: Full Scale Development and Testing of seven (7) prototype air vehicles. Emphasis will be placed on verifying actual system performance through joint and integrated test and evaluation. Air Force peculiar efforts include development and integration of service unique systems for test and evaluation in FY 1988. Development Test and Evaluation (DT&E)/Operational Test and Evaluation (OT&E) will be a combined contractor/government effort. JVX Production Release begins in FY 1989 for the Marine Corps. Production Release for the Navy and Air Force is in FY 1991 leading to Air Force SOF Initial Operational Capability (IOC) in FY 1994. Production of 80 aircraft for the Air Force will be completed in FY 1997.

C. (U) Major Milestones:

	Milestones	Dates
(1)	Preliminary Design Contract Award	April 1983
(2)	Full Scale Development Contract Award	June 1985
(3)	Long Lead Release	3 Q FY 1987
(4)	Operational Test and Evaluation	2 Q FY 1991
(5)	Full Production Release	4 Q FY 1991
(6)	First USMC Delivery	3 Q FY 1991
(7)	First USAF Delivery	4 Q FY 1993

8. (U) PROJECTS MORE THAN $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63307F
DOD Mission Area: #214 - Ground Based Anti-Air and Tactical Missile Defense

Title: Air Base Survivability (ABS)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,774	4,426	6,178	7,198	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this continuing program is to initiate improvements in Air Force Air Base Survivability (ABS). Efforts focus on integrating operational concepts planning with research, development and acquisition programs to provide a sustained sortie generation capability should hostilities occur on or in proximity to an air base. The Air Force must ensure enough people, aircraft, facilities and key supporting systems at theater air bases can survive an enemy attack so air power can be continuously and effectively employed throughout a conflict. To accomplish this, the Air Force has formulated an Air Base Survivability effort.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	3,794	4,426	5,101		Continuing	N/A

RDT&E was reallocated to provide an orderly progression of projects from initial development into Full Scale Development/ Production

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands): Not Applicable

5. (U) RELATED ACTIVITIES: Funding for ABS was provided in FY 1982 and FY 1983 from PE 64708F/Project 2895, Other Operational Equipment/Air Base Survivability. Efforts will be continued in FY 1984 in PE 64617F/Project 2895, Air Base Survivability.

6. (U) WORK PERFORMED BY: Armament Division, Aeronautical Systems Division, Air Force Engineering and Services Center, Electronic Systems Division and the Army will be working on interrelated studies and developing/demonstrating near-term ABS capabilities.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: Air Base Survivability

A. (U) Project Description: ABS is a large and interrelated program with five mutually supporting elements: (1) active defense; (2) passive defense; (3) base recovery; (4) commmand, control, and communication (C^3) survivability; and (5) aircraft enhancements. This program also funds the continuing integration, planning and conceptual efforts of the ABS Systems Management Office (SMO). The SMO provides overall management of all Air Force ABS development and acquisition programs.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Continued ABS integration and the following RD efforts: (1) Active Defense - Mobile Weapon System Demonstration; (2) Passive Defense - Commanders Guide United States Air Force Europe (USAFE) delivered, prepared manual on camouflage methods and techniques, continued evaluation of various aircraft decoys, initiated design of shelters for the TR-1 and War Reserve Support Kit/Base Level Supply System (WRSK/BLSS); (3) Recovery - started expansion of Base Recovery After Attack (BRAAT) data base, initiated design of armor hardening kit to protect EOD ORACLE system operators and completed demonstration; (4) Aircraft Enhancement - Portable Tactical Approach Guidance System demonstration completed; and (5) Integration - Measure of Merit (MOM) modeling completed for generic USAFE and Korean air bases, continued planning for SALTY DEMO, hosted worldwide ABS Investment Strategy Planning Conference.

(2) (U) FY 1985 Program: Funds continuing SMO operations and initiatives which include planning for and execution of SALTY DEMO; investigation of Camouflage, Concealment, & Deception (CCD) methodology; development and demonstration of aircraft decoys and other CCD techniques and technologies (i.e., smoke); completion of TR-1 and WRSK/BLSS shelter designs; BRAAT data base expansion to include information from target activated munitions clearance and operations data study trials; expansion of MOM modeling to generic Pacific Air Forces (PACAF) and South West Asia (SWA) bases; incorporation of SALTY DEMO results in MOM models; initiation of work on portable airfield lighting; demonstration of a mobile emitter locator system as well as tactical land mobile radio equipment; and continuing analysis, flight simulation and design of the aircraft ski-jump.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The continuation of System Management Office operations and initiatives which include development of Camouflage, Concealment, & Deception equipment and techniques; portable airfield lighting development; Base Recovery After Attack data base expansion; Measure of Merit (MOM) modeling of specific air bases; further incorporation of SALTY DEMO results into MOM models; expansion of shelter design efforts; demonstrations to prove the utility of available techniques and equipment for ABS; and construction of the aircraft ski-jump ramp.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) SALTY DEMO Demonstration	April-May 1985
(2) BRAAT Ops Data Study Complete	March 1985
(3) Large Aircraft Shelter Study Design complete	March 1985
(4) CCD Program Study Report	May 1985
(5) SALTY DEMO Final Report	September 1985

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63320F
DOD Mission Area: #224 - Defense Suppression

Title: Lower Cost Antiradiation Seekers
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	3,000*	17,613	17,624	Continuing	N/A

* $3,000 Thousand appropriated in PE 64302F in FY 1985

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element is for advanced development of Anti-Radiation Weapons. The increased sophistication, concentration, and lethality of enemy ground based, radar guided, missile and antiaircraft artillery systems threaten the ability of tactical aviation to accomplish its mission and survive. Anti-radiation missiles provide a lethal counter to this threat. The Tactical Air Forces require a system that enhances aircraft survivability during mission accomplishment. A variety of Anti-Radiation weapon concepts are under consideration to accomplish this goal. The Lower Cost Seeker (LCS) is a US Navy derivative concept of the US Army Anti-Radiation Projectile design which provides an opportunity to meet High Speed Anti-Radiation Missile (HARM) performance requirements. HARM is being acquired by the Navy and Air Force to meet an immediate need for an upgraded capability against current threats. The F-4G Wild Weasel represents the only dedicated lethal defense suppression weapon system in the Air Force inventory, HARM is its primary weapon. Other Anti-Radiation weapons under consideration include short-range, low cost self-protection missiles for all tactical platforms.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: No FY 1985 Descriptive Summary was submitted. FY 1985 Lower Cost Seeker Activity was contained in PE 64302F.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable. Procurement funding will be under separate system Program Elements (HARM: PE 27162F).

5. (U) RELATED ACTIVITIES: HARM, PE 27162F, has been designated as the primary Anti-Radiation Missile for the F-4G Wild Weasel. A Memorandum of Agreement of July 1975 between the Air Force and Navy Assistant Secretaries for Research and Development names the Navy as the Executive Service and the Air Force as the Participating Service in the Joint Service HARM Development Program. The F-4G APR-38 Radar Homing and Warning Receiver is optimized in Program Element 27136F, F-4G Wild Weasel Squadrons, to fully utilize HARM's capabilities. Navy resources for Lower Cost Seeker (LCS) development are in Program Element 63301N, Electromagnetic Radiation Source Elimination (ERASE). Additionally, preliminary Self Protection Weapon work is covered in PE 63601F, Conventional Weapons.

6. (U) WORK PERFORMED BY: Air Force Program Management is provided by Headquarters Air Force Systems Command, Andrews Air Force Base, MD, and its subordinate organization, Armament Division, Eglin AFB, FL. Government facilities such as the Aeronautical Systems Division, Wright-Patterson AFB, OH; Naval Weapons Center, China Lake, CA; and the Air Force Flight Test Center, Edwards AFB, CA are also utilized. Air Force independent testing is conducted by dedicated personnel from the Air Force Operational Test and Evaluation Center (AFOTEC), Kirtland AFB, NM; and by operational Tactical Air Command pilots detailed to the AFOTEC test detachment from George AFB, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 63320F, Lower Cost Antiradiation Seekers Development

A. (U) Project Description: This project includes the design and development of seekers and necesary subsystems to field future anti-radiation missiles. The Air Force, as participating service in the Joint Navy/Air Force Lower Cost Seeker (LCS) Program, will fund those development efforts that are unique to the Air Force. The Air Force's emphasis is to integrate the LCS with the HARM and F-4G. This integration requires the development and testing of computer software to certify the missile for carriage and launch from the aircraft, and ground flight tests of the Avionics/Missile Interface. Additionally, peculiar Air Force ground support equipment and technical manuals will be developed.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable (FY 1985 New Start)

(2) (U) FY 1985 Program: This FY 1985 effort was funded in PE 64302F. System contractors will be contracted for support of the in-house lab development. The contractors will assist in producing components for test and evaluation and will be responsible for ensuring producibility of the government developed design. Consideration of Air Force unique integration tasks on the F-4G aircraft will recieve early Air Force priority.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Complete engineering unit evaluation leading to CDR (Critical Design Review). CDR will establish the allocated functional baseline. Each contractor will build prototype units which will undergo qualification testing conducted by Naval Weapons Center. Other system developments will occur, as required. The LCS program cost estimate was performed by the Navy.

(4) (U) Program to Completion: During FY 1987 prototype unit qualification will be completed leading to selection of the Lower Cost Seeker (LCS) final design. Each contractor then builds 20 prototype units for Initial Operational Test & Evaluation starting late in FY 1988. LCS production starts in FY 1989.

C. (U) Major Milestones: TBD

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63609F   Title: Millimeter Wave Seekers
DOD Mission Area: #223 - Close Air Support and Interdiction   Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	5,000	19,113	15,947	Continuing	N/A
3049	Millimeter Wave Technology	0	5,000	19,113	15,947	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Millimeter Wave Seeker Program, formally the Advanced Attack Weapons Program, provides for the development of advanced guidance and warhead components to meet the Tactical Air Forces General Operational Requirement 302-78 to accurately deliver air-to-surface weapons on a variety of target types in battlefield conditions under adverse weather during day or night operations. A specific requirement is the capability to place massive and accurate fire on the target without the pilot having to physically see it. The Millimeter Wave (MMW) Seeker Program exploits advances made in the WASP program which successfully demonstrated an autonomous lock-on-after-launch capability with MMW guided missiles which hit tank targets in travel formation. The MMW Seeker Program is a competitive multicontract effort which will provide for the demonstration/evaluation of second generation millimeter wave seekers. Significant advances have been made in MMW technology which can be exploited through this technology demonstration program to provide adverse weather, lock-on-after-launch weapons for antiarmor or other high value target. This program should lead to a Full Scale Development (FSD) effort beginning in FY 1988 to incorporate a MMW Seeker in existing weapons and/or weapons presently funded for development.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	0	20,024	24,397		Continuing	N/A

(U) Congress appropriated only $5.0 Million of the $20.024 Million requested in FY 85. As a result, the scope of the program was reduced to applications to existing and developing weapons vice new weapons concepts. Captive flight testing will be delayed to FY 86. The FY 86 estimate was reduced because the program was restructured to slip the FSD start one year to FY 88.

Program Element: #63609F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Millimeter Wave Seekers
Budget Activity: #4 - Tactical Programs

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Technology support for this program is ongoing in Program Elements 62602F, Conventional Munitions, and 63601F, Conventional Weapons Technology.

6. (U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews AFB, MD and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Contractors for this effort have not been selected.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3049, Millimeter Wave Technology Program

A. (U) Project Description: The Millimeter Wave (MMW) Technology Program was established to exploit the significant advances recently made in MMW technology through demonstration of state of the art MMW seekers. The ultimate objective is to insert this technology into an existing weapon and/or weapons presently in development. Full Scale Development of the seeker/weapon combination(s) selected will begin in FY 88.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The MMW Technology Program was initiated in FY 1984. Specific procurement documentation was prepared, including the acquisition plan and statement of work. Detailed plans for the contracted demonstration program were completed. Some of the remaining FY 83 funds were carried forward to support a minimal contractor activity in FY 84.

(2) (U) FY 1985 Program: Multiple contracts will be awarded for the development and demonstration of millimeter wave seekers. Specific functional designs will be selected, test plans developed, and a common interface defined.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Flight tests of competing seeker designs will be flown aboard government and contractor aircraft. The seekers will be tested against a variety of targets in various forms of clutter. Form, fit and function evaluations of prototype weapon systems will be performed and tests will be conducted against various types of countermeasures. A parametric estimating technique was used to calculate the program cost estimate in September 1984 (Cost category IV, Planning). Contractor cost information has not been provided. This information will be provided in upcoming proposals. A two and one-half year demonstration program is planned.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones		Dates
1. (U) General Operational Requirement		January 1978
2. (U) Contract Award	*(October 1984)	June 1985
3. (U) Captive Flight Test Start	*(3rd Quarter FY 1985)	1st Quarter FY 1986
4. (U) Complete Test	*(FY 1988)	FY 1988
5. (U) Begin Full Scale Development		FY 1988
6. (U) Acquisition Plan and Preliminary Cost Estimates		*(February 1985)

* Data presented in FY 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(2) Contract award slipped due to change in scope dictated by $15 Million Congressional reduction in FY 1985 request which required resubmission of the Determination and Findings documentation.

(3) Captive flight test will be delayed to FY 1986 because the FY 1985 appropriation of $5.0 Million is not sufficient to support three contractors with captive carry tests in FY 1985.

(4) Captive flight test will be completed in FY 1988, reflecting the restructuring required in light of the FY 1985 Congressional action discussed above.

(6) Acquisition plan and preliminary cost estimates will be provided to Congress in accordance with the FY 1985 Senate Armed Services Committee language.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63714F
DOD Mission Area: #205 - Physical Security Systems

Title: DOD Physical Security Equipment-Exterior
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,601	1,885	1,010	999	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the advanced development of the Department of Defense Base and Installation Security System, a standardized exterior physical security system, by accomplishing advanced development tasks in three functional areas: detection, command and control, and imaging. A Department of Defense need exists for a family of standardized modular equipment, which can be integrated in to system configurations to provide a level of security in consonance with the deployment mode, threat level, and sensitivity of the asset being protected. The resulting security equipment increases the capability of the security forces to detect and intercept terrorists and permits increased mobility of the forces for better utilization of existing manpower.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	3,601	1,885	932		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Full-scale development of equipment, subsystem/system integration and test, and production specification development is accomplished under Program Element 64715F, Department of Defense Physical Security Equipment-Exterior (Engineering Development). Procurement of physical security equipment is accomplished using Other Procurement-Air Force funding under Program Element 27589F, Base Physical Security Systems. The Base and Installation Security System equipment will be designed for interoperability with the Army interior security system (facility intrusion detection system) and the Army tactical sensor system (remotely monitored battlefield sensor system). This program also interfaces with an exploratory development program for nuclear site security managed by the Defense Nuclear Agency. Management oversight of the physical security equipment programs is provided by the Department of Defense Physical Security Equipment Action Group with the Chairperson residing in the Office of the Under Secretary of Defense for Research and Engineering.

6. (U) WORK PERFORMED BY: This program is managed by the Physical Security Systems Directorate, Electronic Systems Division, Hanscom AFB, MA. Department of Defense agencies performing development tasks are: Rome Air Development Center, Griffiss AFB, NY; Army Mobility Equipment Research and Development Command and Army Night Vision Laboratory, Fort Belvoir, VA; Army Waterways Experimental Station, Vicksburg, MS; Naval Ocean Systems Center, San Diego, CA; and the Naval Coastal Systems Center, Panama City FL. In addition to these Defense agencies, the Department of Energy/Sandia Laboratories, Albuquerque, NM, performs advanced development tasks and the Analytical Systems Engineering Corporation assists in the system engineering support and integration task.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: PE 63714F, DOD Physical Security Equipment - Exterior

A. (U) Project Description: This program responds to Secretary of Defense direction contained in Department of Defense Directive 3224.3, 1 December 1976, which designates the Air Force as executive agency for the development of standardized exterior physical security equipment and systems for protection of bases and installations. A world-wide increase in the level of terrorist threat and a greater emphasis on security protection for mission-critical resources necessitate the development of a standardized system capability for use by all Defense agencies. The objectives are to provide a capability for high level security, against all threat levels, for resources in three deployment modes: permanent, semipermanent, and mobile. This program provides a technology base, accomplishes advanced development tasks, and develops prototype equipment for full-scale development. Maximum utilization is being made of technology and prototypes developed by other Services and commercial sources whenever feasible.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The radar airborne intrusion detection system, a sensor for use in detecting airborne threats, completed advanced development in FY 1984.

(2) (U) FY 1985 Program: Advanced development will continue in infrared signal analysis, advanced signal processing techniques, and sensor data acquisition. These areas provide the basis for advanced intrusion detection systems. The infrared charge coupled device sensor, for applications where perimeters will not be lighted, will also continue in FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: This program provides funds for the continued advanced development of technologies and prototype equipment for security applications. Equipment that is developed will be used to protect high value resources. Primary emphasis will be placed on sensor data acquisition and signal processing techniques. These efforts will provide better utilization of existing sensor outputs by providing central processing to reduce nuisance alarms and improve the probability of detection. IR signal processing techniques and IR sensor development will be continued for applications where non-lighted perimeters must be protected. Cost estimates are based on inputs from various government agencies performing these development efforts which were updated in September 1984.

(4) (U) Program to Completion: This program will provide technology and prototype and equipment for engineering development of the Base and Installation Security System. Advanced development tasks will continue at a nominal level subsequent to the availability of the Total Base and Installation Security System capability to keep the system current with the state-of-the-art technology.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63742F
DOD Mission Area: #344 - Tactical Command and Control

Title: Combat Identification Technology
Budget Activity: #4 - Tactical Program

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		13,060	15,376	8,763	2,088	Continuing	N/A
1177	Noncooperative Identification Techniques	2,900	2,715	2,500	2,088	Continuing	N/A
2599	Cooperative Identification Techniques	10,160	12,661	6,263	0	0	45,105

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is to accomplish advanced development of technologies that can be used to provide reliable long range identification of airborne targets in all-weather and hostile electromagnetic countermeasure environments. This program is necessary because the numerical superiority of the projected threat demands that we be capable of engaging the enemy at long ranges with our beyond visual range weapons. The long range identification that is a prerequisite for such engagements

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	Additional to Completion	Total Estimated Cost
RDT&E	13,499	19,324	10,335	Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Air Traffic Control Radar Beacon System/Mark XII; PE 63706A, IFF Developments, PE 64709A, Identification Friend or Foe (IFF) Equipment, and PE 64725F, Combat Identification Systems. Coordination and integration of the various activities under these program elements are accomplished through the Combat Identification System Program for which the Air Force is lead service.

6. (U) WORK PERFORMED BY: The overall program is managed by the Combat Identification System Program Office (CISPO) at the Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson Air Force Base, OH. The Air Force, Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson Air Force Base, OH is managing Project 1177 for the CISPO. Contractors supporting project 1177 are: Bendix Corp., Baltimore, MD; Hughes Aircraft Co., Culver City, CA; McDonnell Douglas Aircraft Corp., St. Louis, MO; Loral Electronic Systems, Yonkers, NY; and Veda Inc., Dayton, OH. The CISPO manages project 2599. Contractors providing support to Project 2599: Bendix Corp., Baltimore, MD; E-Systems, St. Petersburg, FL; Texas Instruments, Inc., Dallas, Texas; Teledyne Electronics, Newberry Park, CA; Raytheon Corp., Sudbury, MA. Support is also provided to project 2599 by the Massachusetts Institute of Technology Lincoln Laboratory, Lexington, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 1177, Noncooperative Identification Techniques. Beyond visual range identification of airborne targets is [ ] In March 1978, North Atlantic Treaty Organization (NATO) Long Term Defense Program Task Force Five on Air Defense [ ] Because of [ ] several complementary cooperative and noncooperative identification techniques, as well as their integration, are being developed under the Air Force-led, Tri-Service Combat Identification System Program. This project accomplishes the advanced development of techniques for performing noncooperative target identification. Included in these techniques is the Radar Warning Receiver/Fire Control Interface Software (RFIS) effort to demonstrate the feasibility of using radar warning receiver information to establish accurate multiple target tracks and identification for beyond visual range air-to-air missile fire control. The RFIS simulation continued in FY 1984, concluding in December 1984. The Preliminary Design Assessment (PDA) started in September 1984. The PDA uses a full scale F-15 mock-up to test antenna patterns for the RFIS. Algorithm development and testing under PDA was also begun. For FY 1985, the PDA continues on the RFIS to lead to a late FY 1985 decision on transitioning the technique to the F-15 Program Office for aircraft incorporation. Another technique in development is Multi-Source Integration (MSI). This will demonstrate the feasibility and utility of integrating cooperative and noncooperative, active and passive, and direct and indirect identification onboard the aircraft. This will provide high confidence identification of air-to-air targets beyond visual range. The advanced MSI algorithm was completed in FY 1984 and work started on an MSI system for a Joint Tactical Information Distribution System (JTIDS) simulation. The initial task was to define the identification (ID) system to be used in the simulation. Interface requirements from sensors in the MSI scheme were defined. The MSI work on the JTIDS simulation continues in FY 1985 with the test plan definition and software development to be integrated into a manned simulation. Further development of interface requirements for ID sensors continues with a design review scheduled in mid-FY 1985. Other work includes development of an [ ] In FY 1984 the airframe ID feasibility

study concluded and the final report was begun. Results are expected to show what modifications [ ] are needed, whether the technique is useful, and what algorithms would be used. A second [ ] identification algorithm development to ascertain feasibility of techniques continues development through 1985. The planned program for FY 1986 includes a new subproject to gather data on possible infrared identification systems. The program is designed to piggy-back on the Advanced Target Acquisition Sensor (ATAS) flight test program already scheduled. Also in FY 1986, the Multi-Source Integration (MSI) work will conclude with a real-time simulation, development of interface specifications, and a decision to transfer to aircraft program offices for production incorporation. An assessment of using the command and control function for identification (ID) purposes will start. Data gathering for [ ] ID technique will start to support the earlier algorithm development. Budget estimate has a confidence level of IV. Last revision was April 1984.

B. (U) Project: 2599, Cooperative Identification Techniques: This project is part of a Tri-Service (Air Force led) effort under the Combat Identification System (CIS) Program, to evolve comprehensive and balanced improvements to U.S. identification capabilities worldwide. For these improvements to have maximum effectiveness they must be interoperable with the identification capabilities of U.S. allies. To this end the United States is cooperating with the other NATO nations to reach agreement on the basic operating characteristics (e.g., signals-in-space) of future identification equipment. The work in this project addresses the development of a direct, cooperative identification sysem (i.e., use of cryptographically secure questions and answers), called the Mark XV, to replace the aging Mark XII system. This work is complemented by direct, noncooperative and indirect identification techniques being pursued by other projects within this and other program elements. The thrust of the effort is the design and testing of advanced development models of the Mark XV system. The results of such tests will support the initiation of full scale development activities under Program Element 64725F, Combat Identification Systems, and will also provide the basis for validating the interoperability agreement with NATO prior to its formal ratification by the NATO nations. In FY 1984 fabrication and testing of Mark XV experimental models was successfully completed. The testing verified frequency compatibility studies/simulations, wave form performance analyses and circuit design. These activities were conducted in close cooperation with France, Germany and the United Kingdom. These nations, based on the specific wave form provided by the United States and the strong U.S. position taken in NATO regarding the unaffordability of an alternate frequency band approach, continued to build their own Mark XV experimental models for test and analysis. The British and French tests of their D-Band systems for electromagnetic compatibility are due to conclude in early Calendar Year 1985. The German 18 month frequency allocation study is due to conclude in December 1984. The results of these tests and studies will form the basis for national decisions and subsequent negotiations with the goal of reaching an agreement on the operating frequency in late FY 1985. A Program Review was held in February 1984 at which time the tri-service fund sharing arrangement was settled. The Defense Systems Acquisition Review Council (DSARC) I was held on 24 July 1984. The Secretary of Defense directed that the program proceed into the Demonstration/Validation (D/V) phase by exercising existing contract options while pursuing a restructuring of the D/V phase to focus on risk reduction efforts. The Multi-Command Required Operational Concept for the Next-Generation Question-and-Answer Identification Friend or Foe (IFF) was also validated by all services and the Joint Chiefs of Staff. During FY 1985, the program office will negotiate with the contractors to restructure the

Demonstration/Validation (D/V) phase. The Program Office will prepare a plan for the new D/V phase, rewrite the Systems Concept Paper and Test and Evaluation Master Plan, and submit to the Office of the Secretary of Defense (OSD)for approval. After approval, the contractors will continue their design analyses and trade studies and begin to fabricate several flyable advanced development models of the Mark XV. Test planning will continue and government support of the German frequency allocation study will continue. For FY 1986, advanced development models will be completed and a tri-service test program will be conducted. The specifications for full scale development (FSD) will be completed and the Request for Proposal (RFP) prepared. A full competition will begin, with contractor responses to the RFP initially evaluated. Service-unique testing of the hardware will start. The preparations for the OSD Decision Briefing to enter FSD in FY 1988 will start. Upon entering FSD, the Mark XV program will transition to PE 64725F, Combat Identification Systems. For this phase of the program, the budget estimate has a confidence level of II. The last budget revision was September 1984.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

Budget Activity: 4, Tactical Programs
Program Element: 63742F, Mark XV

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Aeronautical Systems Division (ASD) of the Air Force Systems Command is the program manager for this tri-service program. DT&E is currently projected to be conducted in two phases (DT&E-I and II) with the first phase to commence in early FY 1987. DT&E-I will consist of Advanced Development Model (ADM) equipment tested under laboratory conditions in the Demonstration/Validation (D/V) contractor's facilities with additional D/V testing to be conducted using Air Force ASD/4950th Test Wing aircraft which will be modified for Mark XV testing. The D/V phase includes form, fit, and function (F^3) analysis and demonstration to determine if the required technology is available to permit full scale development within size, weight, and power constraints and to reduce risk entering FSD. Flight testing conducted during DT&E-I will be used to verify the data base gathered during laboratory testing and to perform tests unique to flight testing using simulated threat and signal densities. This testing will be conducted in the Wright-Patterson AFB, Ohio area utilizing the 4950th modified T-39 and C-135 aircraft and the ASD Identification Friend or Foe (IFF) ground station equipment, and at Naval Air Test Center (Pax River) for overwater multipath.

(U) DT&E-II will be conducted as part of the Full Scale Development effort with the 4950th Test Wing as the responsible test organization. Emphasis during this phase will be placed on Mark XV reliability under expected combat conditions, interoperability with NATO Mark XV equivalent systems, demonstration of Full Scale Development contract specified performance parameters, and estimation of maintainability and supportability.

2. (U) Operational Test and Evaluation (OT&E) : Air Force Operational Test and Evaluation Center (AFOTEC) has been directed to conduct the Mark XV IFF tri-service OT&E program supported by the Army's Operational Test and Evaluation Agency (OTEA) and the Navy's Operational Test and Evaluation Force (OPTEVFOR). The IOT&E of the Mark XV will be conducted during both the D/V (IOT&E-I) and the Full-Scale Development (IOT&E-II) portions of the program.

(U) IOT&E(I). This phase of IOT&E is to evaluate the operational aspects of the ADMs. It will provide an early evaluation of the operational utility of the Mark XV design approach. Data from interviews, documentation reviews, and questionnaires will be used in the evaluation. D/V flight tests of the ADM hardware will be observed. Testbeds will include an AF C-135, T-39, and a ground interrogation capable system. Test sites will be Wright-Patterson AFB, Ohio, and Patuxent River Naval Air Station. This phase is scheduled for December 1986 to March 1987.

Budget Activity: 4, Tactical Programs
Program Element: 63742F, Mark XV

(U) IOT&E(II). The IOT&E(II) of the Mark XV will evaluate preproduction equipment in operational platforms. It will include extensive tri-service field testing under operational conditions in both multiservice and service-unique scenarios. The Army's Operational Test and Evaluation Agency (OTEA) and the Navy's Operational Test and Evaluation Force (OPTEVFOR) will manage the OT&E on their particular service scenarios. Air Force Operational Test and Evaluation Center (AFOTEC) will manage AF and multiservice scenarios. Test platforms will include: AF, Navy, and Army airborne platforms; Army (Patriot, Stinger, Sergeant York) air defense platforms, Navy (cruisers and destroyers) surface combatants; and an AF tactical radar system. Test sites will be Nellis AFB, Nevada, Patuxent River NAS, and Pt Mugu NAS. This phase is scheduled for January 1990 to August 1990. Following testing of the Mark XV in the CONUS, additional testing will be conducted that will involve US- and NATO-built Mark XV IFF equipment on US and NATO platforms. These platforms are yet unspecified. Test sites have not been selected but most likely will be located in West Germany. This test segment is scheduled for September 1990 to March 1991.

(U) Lessons learned from the recently conducted Mark XII IFF technical improvement program (TIP) IOT&E will be extremely valuable in the conduct of this IOT&E. The different results between its DT&E and IOT&E (DT&E favorable and IOT&E unfavorable) highlight the importance of early OT&E on IFF systems.

3. (U) System Characteristics : Characteristics for the Mark XV will be definitized during the Pre-FSD phase. The primary objective of the program is to develop a NATO interoperable, jam resistant, and secure cooperative system to identify friendly aircraft and ships. Specific thresholds for the Mark XV system will be identified before the Defense Systems Acquisition Review Council (DSARC) II review.

Characteristic	Objective (Goal)	Demonstrated	Remarks
Operational Range	Platform Dependent For example (Representative goals):	To be determined	Will be equal to or greater than primary weapon system sensor range
	Fighter Aircraft (e.g., F-15/F-14) [ ]		
	Airborne Early Warning (e.g., E-3A) [ ]		
	Surveillance Radar (e.g., TPS-43) [ ]		
	High Altitude Missile Air Defense (HIMAD) (e.g., Patriot) [ ]		

Budget Activity: 4. Tactical Programs
Program Element: 63742F, Mark XV

Characteristic	Objective (Goal)	Demonstrated	Remarks
	Man Portable Air Defense (MANPAD) (e.g., Stinger) [ ]		
System Capacity	[ ] interrogations/second	To be determined	Based on most dense European environment
Anti-Jam Performance	[ ] jamming/signal margin	To be determined	Based on broad band noise jamming
Identification Reliabilities			
P (Friend Acceptance/Friend)	[ ]	To be determined	Probability of accepting a friend given he is a friend
P (Friend Rejection/Friend)	[ ]	To be determined	Probability of rejecting a friend given he is a friend
P (Enemy Acceptance/Enemy)	[ ]	To be determined	Probability of accepting an enemy given he is an enemy
(U) Reliability/Maintainability/Availability			
Mean Time Between Failure	1000 hrs	To be determined	System specified on demonstration in laboratory
Mean Time To Repair	30 minutes	To be determined	On site maintenance

Budget Activity: 4, Tactical Programs
Program Element: 63742F, Mark XV

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Wave Form Demonstration	March to May 1984	March to September 1984	Contractors demonstrated technical feasibility

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Test and Evaluation Master Plan (TEMP) Approved	March 1985	TEMP being revised to reflect restructured program

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63749F
DOD Mission Area: #372 - Escort, Standoff, and Counter C^3

Title: C^3 Countermeasures Advanced Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	990	500	3,463	6,681	Continuing	N/A
2947	Advanced C^3 Countermeasures	990	500	3,463	6,681	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Accomplishment of all Air Force combat operations can be significantly enhanced by With this capability, our commanders can confuse enemy decision makers, deny him control of his forces, delay enemy resupply actions, and disrupt attacks while disguising our own operational intentions. This program provides advanced development and system feasibility demonstrations of promising new C^3 countermeasures technologies and techniques. Projects include: technology demonstrations to improved C^3 countermeasures decision aids for battlefield commanders; advanced development and demonstration of techniques; and architecture development for C^3 countermeasures for use in the 1990's when enemy use of new technologies such as can be expected.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	990	994	4,439		Continuing	N/A

FY 1985 Differences: Congressional Reduction

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: This program was created to support Command, Control and Communications (C^3) countermeasures advanced developments and to accelerate their transition into full-scale development. Laboratory investigations to develop new C^3 countermeasures capabilities will remain in Program Element 63718F, Project Number 2754 - C^3 Countermeasures. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics; PE 62715A, Tactical Electronic Warfare Technology; and PE 63214N, Tactical C^3 Countermeasures. This program provides advanced development for PE 64724F, Tactical C^3 Countermeasures.

6. (U) WORK PERFORMED BY: The Electronic Systems Division of the Air Force Systems Command, Hanscom AFB, MA, is responsible for management of this program. The MITRE Corporation, Bedford, MA, provides technical support to the project office.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2947, Advanced C^3 Countermeasures

A. (U) Project Description: In FY 1981 the Department of Defense recognized the need to create an advanced development program element to support C^3 countermeasures developments and to transition these developments from exploratory to engineering development. As a result, this program element was specifically created to develop improvements to fielded systems as new technologies mature, to provide future C^3 countermeasures possibilities using advanced/new technology, and to ensure interoperability and effective integration of all C^3 countermeasures assets.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Completed and published a Command, Control and Communications Countermeasures (C^3CM) roadmap and Investment Strategy Plan. Performed Red Team vulnerability assessment of the Pave Tiger system. Developed a program management plan for the Radio Electronic Combat Vulnerability Analysis (RVAN) program. Initiated development of an expendable, low-cost C^3 destruction system. Completed C^3 Weapons Analysis Study. Completed advanced development and demonstrated a computer aided

(2) FY 1985 Program: Incorporate blue C^3 characteristics into the computer aided Conduct a C^3CM System Mix Analysis. Demonstrate the low-cost expendable C^3 destruction system. Conduct a field demonstration of C^3CM decision aids. Define measure of effectiveness for C^3CM and initiate measure of effectiveness studies. Support development program. Initiate study of tactical electronic deception. Conduct definition study of

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Update the C^3CM Counter Mission Analysis. Complete advanced development of the low-cost expendable C^3 destruction system and transition to full scale development.

Program Element: #63749F

DOD Mission Area: #372 - Escort, Standoff, and Counter C^3

Title: C^3 Countermeasures Advanced Systems

Budget Activity: #4 - Tactical Programs

Initiate development and testing of [ ] Conduct Enhanced Joint Tactical Information Distribution System (EJS), Joint Surveillance Target Attack Radar System (Joint STARS) Combat Identification System vulnerability assessments. Complete program definition of C^3CM decision aids and transition to full scale development.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63770F
DOD Mission Area: #217 - Land Warfare Surveillance and Reconnaissance

Title: Joint STARS Advanced Development
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0*	3,318	3,200	0	0	61,237

*FY83 and prior funds were in PE 63747F.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A critical need exists for an effective new capability to attack numerically superior Warsaw Pact second echelon armored mobile ground forces. To fill this need, the Air Force and Army have formed the Joint Surveillance and Target Attack Radar System (Joint STARS) Program as a high priority initiative. Joint STARS will detect and track second echelon enemy forces and guide accurate attacks against them via standoff missiles and direct attack aircraft. This advanced development directly contributes to Joint STARS by readying new technological opportunities for use in the Joint STARS system.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	0	3,318	3,270		0	61,307

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. RELATED ACTIVITIES: There is no other system planned to provide closed loop target detection and tracking as well as real-time aircraft cue-vectoring or standoff missile guidance against second echelon armor. Currently, this mission is performed on a [ ] Joint STARS Full Scale Engineering Development, including interfaces with weapons and command and control elements, is conducted under Program Element 64770F, and the companion Army program element, PE 64770A.

6. (U) WORK PERFORMED BY: This program is managed by Air Force Systems Command's Rome Air Development Center, Griffiss AFB, NY, in coordination with the Joint STARS Program Office at the Electronic Systems Division, Hanscom AFB, MA. Two advanced development airborne PAVE MOVER radars were developed and used in the Assault Breaker Technology Demonstration. Contractors for PAVE MOVER were Hughes Aircraft, El Segundo, CA, and Grumman Aircraft, Beth Page, NY, teamed with Norden Systems, Norwalk, CT. This work is complete. These teams are now conducting advanced development work on multimode radars of the Joint STARS class, as are Westinghouse Corporation, Baltimore, MD, and General Electric Corporation, Utica, NY.

Program Element: #63770F
DOD Mission Area: #217 - Land Warfare Surveillance and Reconnaissance

Title: Joint STARS Advanced Development
Budget Activity: #4 - Tactical Program

Lincoln Laboratory, Lexington, MA, helps the Rome Air Development Center evaluate the performance of advanced development radars with particular emphasis on radar characterization,

performance. The MITRE Corporation, Bedford, MA, provides systems engineering support for advanced development as it relates to Joint STARS.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 63770F, Joint STARS Advanced Development

A. (U) Project Description: Joint STARS is an airborne engagement system incorporating moving target indicating and synthetic aperture radar techniques to detect slow moving targets and guide accurate attack against them from stand-off ranges. This project is the advanced development work that complements Joint STARS Full Scale Development.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable.

(2) (U) FY 1985 Program: This project, which produced the successful PAVE MOVER system as part of the DARPA/Army/Air Force Assault Breaker demonstration, focuses on remaining advanced technology efforts needed to reduce technical risks associated with Full Scale Development of Joint STARS. Emphasis is on radar design to insure detection and accurate tracking of very slow moving ground targets, with the added goal of enhancing the electronic counter-counter measure (ECCM) capabilities of multi-mode radars of the Joint STARS class.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Funds requested are for advanced development of technologies to complement and extend Joint STARS' capabilities. A principal goal for FY 1986 is improved

of the Joint STARS radar.

(4) (U) Program to Completion: This program concludes in FY 1986.

C. (U) Major Milestones:

	Milestones	Dates
(1) (U)	Joint STARS Full Scale Development Request for Proposals Released	September 1984
(2) (U)	Joint STARS Full Scale Development Contract Award	April 1985
(3) (U)	Joint STARS Combined Development/Operational Test & Evaluation Begins	October 1988

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64201F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Aircraft Avionics Equipment Development
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	18,385	19,979	29,397	29,373	Continuing	N/A
2257	Standard Avionics and Joint Services Review Committee (JSRC) Initiatives	3,064	3,030	3,000	5,000	Continuing	N/A
2258	Inertial Navigation Unit (INU) Developments	900	900	8,600	3,000	Continuing	N/A
2297	Embedded Computer and Software Standardization	2,400	2,379	2,500	2,500	Continuing	N/A
2519	Generic Radar Improvements	7,041	8,900	8,795	13,273	Continuing	N/A
2560	JOVIAL Language Control Facility	1,200	1,100	1,200	1,600	Continuing	N/A
2590	Mission Planning Calculator System (MPCS)	38	530	0	0	0	733
2658	Avionics Architecture Implementation and Support	900	1,100	1,502	2,000	Continuing	N/A
2771	Standard Central Air Data Computer (SCADC)	1,070	140	0	0	0	6,010
2993	Digital Audio Distribution System (DADS)	1,772	1,900	3,800	2,000	1,000	11,072

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The high cost of operating and maintaining our forces is reducing operational capability and readiness. This program element develops standard architectures and airborne electronic equipment that will reduce support costs and allow technology evolution to provide overall operational force improvements. Joint avionics development efforts are pursued through participation in, and support of the Joint Services Review Committee (JSRC). Current JSRC initiatives undergoing development at this time include an Air Force/Navy Standard Central Air Data Computer, a Tri-Service DADS (standard aircraft intercom system), a Ground Collision Avoidance System (GCAS) and a Standard Flight Data Recorder (SFDR). In addition, this program supports generic radar applications to improve performance, reliability and maintainability of current Air Force airborne fire control radars, and the development of a mission planning calculator system. dditionally, this program funds necessary ongoing support activities to ensure a credible avionics standardization program is maintained.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	18,810	25,809	25,395	Continuing	N/A

EXPLANATION: - FY 1985 decrease as a result of a Congressional reduction
- FY 1986 rephasing consistent with the overall Air Force budget priorities

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This program is closely coordinated with the Army and Navy to maximize joint developments where feasible. Multiservice initiatives are supported through participation in the Joint Services Review Committee. In addition, a tri-service memorandum of agreement has been established to promote interservice standardization. Currently a joint effort with the Navy Program Element 64203N, Avionics Components Subsystems, is underway to develop a Standard Central Air Data Computer. A Digital Audio Distribution System is being developed jointly with the Navy and Army. There is a close relationship between the products of this program and the technological building blocks developed in advanced and exploratory development programs such as PE 63203F, Advanced Avionics for Aircraft; PE 63253F, Advanced Systems Integration Demonstration; and PE 62204F, Aerospace Avionics. Techniques, components and subsystems showing high payoff potential can be progressively transitioned through the development process until a specific weapon system application is identified and an engineering development task established. The Generic Radar Improvements project investigates the generic radar improvements possible (such as terrain following/terrain avoidance and synthetic aperture radar with initial application in the F-15, F-16 and B-1B). For example, radar electronic counter-countermeasures test data obtained from PE 63750F, Counter/Countermeasures-Advanced Development, will aid in developing software for this project.

6. (U) WORK PERFORMED BY: Program management is provided by Air Force Systems Command under the direction of the Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts of Project 2257 are with the Analytic Sciences Corporation, Reading, MA, and Aeronautical Radio Inc., Annapolis, MD. Project 2519 is contracted with Hughes Aircraft Corporation, Culver City, CA, and with Westinghouse Electric Corporation, Baltimore, MD. The project 2560 contractor is SOFTECH Inc., Waltham, MA. Project 2297 contractor is TRW, Dayton, OH. Project 2993 contractors are Telephonics Corporation, Hempstead, NY, and Magnavox Corporation, Ft Wayne, IN. Project 2590 is currently in the source selection process with contract award expected in Jan/Feb 1985.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project 2257, Standard Avionics and Joint Services Review Committee (JSRC) Initiatives: This project assists the Deputy for Avionics Control, Aeronautical Systems Division, with identification and assessment of systems and subsystems to be developed and/or designated as Air Force standard items. It evaluates the standardization potential of candidate systems and, when necessary, initiates hardware development. It also develops specifications and standards for systems/subsystems that have been approved for standardization. Coordination with appropriate services is accomplished through participation in and support of the Joint Services Review Committee. During FY 1984 a program was initiated to develop a standard algorithm for a Ground Collision Avoidance System (GCAS), qualification testing of a standard 8-day clock was begun, and development of EMI/EMC (electromagnetic interference/compatibility) design standards were completed. In addition extension of the Avionics Data Utilization System continued. During FY 1985 the GCAS algorithm will be completed and initial testing for onboard aircraft applications will begin. Formulation of an acquisition strategy and a follow-on Government Furnished Equipment (GFE) program will be started for the Standard Flight Data Recorder (SFDR). These efforts will be based on the F-16 SFDR development effort which used the tri-service developed SFDR specification. Finally a newly developed MIL-STD-XXXX, Avionics Interface Design Standard will be released. During FY 1986 this project will continue providing the front-end activity needed to determine the feasibility of standardizing selected avionics systems/subsystems identified through the Air Force and joint service avionics planning process. The feasibility of developing dedicated GCAS hardware will be investigated and development of the GFE SFDR will continue.

B. (U) Project 2258, Inertial Navigation Unit (INU) Developments: This project was reactivated in March 1984 with FY 1984 and 1985 funding drawn internally from within the program element. It will upgrade the Air Force's Standard Form, Fit, Function (F^3) and F-15 Inertial Navigation Units (INUs) by incorporating ring laser gyro (RLG) technology and will ensure multiple sources are available for both INU procurements. The F^3 INU program consists of a demonstration portion to show that no degradation of navigation accuracy occurs in a vigorous military aircraft environment, and a qualification portion where prospective manufacturers will be required to submit their respective systems for testing to ensure compliance with the Standard F^3 INU specification (SNU 84-1). F^3 INU development will be funded by each contractor while the Air Force will fund all demonstration/acquisition testing costs at the Central Inertial Guidance Test Facility (CIGTF). During FY 1984 a revised F^3 INU Specification (SNU 84-1) was released to include inertial navigation requirements in three areas -- enhanced, precision, and medium accuracy -- and to permit incorporation of new technologies such as ring laser gyros (RLG). Qualification testing was begun on three F^3 RLG INU systems (Honeywell, Litton, and Singer) at CIGTF. In FY 1985, certification of these initial RLG systems at CIGTF will be completed. Production contracts will be awarded for the medium accuracy F^3 RLG INU (initial application to the C-130 and RF-4). In addition, qualification testing of precision accuracy Standard INUs will be completed and a production contract awarded. (Note: Procurement funds are included in the individual aircraft lines and not under this program element.) Also in FY 1985 we will begin the development of a universal Kalman Filter which will greatly improve F^3 INU integration efforts. This effort will complete in FY 1986. Initial production deliveries of the new technology standard INUs will begin during FY 1986. Production model verification testing will be initiated and the Standard INU specification will be updated as required. The F-15 RLG INU program will include development and certification of multiple sources for the F-15 INU program. This development effort will start in FY 1985 and complete in FY 1986, with CIGTF qualification occurring in FY 1986.

C. (U) Project 2297, Embedded Computer Software Standardization: This project supports and maintains the Embedded Computer Standardization Program Office (ECSPO) within the Air Force's Deputy for Avionics Control. The ECSPO provides Air Force weapon systems programs with timely, high quality MIL-STD-1589 (JOVIAL) J-73 compilers, MIL-STD-1750 16-bit Instruction Set Architecture, and the required support software for both. An ongoing effort assesses problem reports and carries out the necessary maintenance activities to ensure adequate support of the Air Force's J-73 and MIL-STD-1750 support software. During FY 1984 a production quality VAX 11/780 hosted JOVIAL compiler was released. This increased the user base from less than 30 organizations in early FY 1983 to over 200. An improved VAX hosted MIL-STD-1750 assembler, linker and simulator for JOVIAL/1750 users was also released. Development of a totally integrated JOVIAL and MIL-STD-1750 tool set was started and development of an Ada-to-MIL-STD-1750A code generator was initiated in cooperation with the Air Force Wright Aeronautical Laboratory. During FY 1985 a totally integrated JOVIAL core tool set (compiler, assembler, linker, and debugger) will be completed and program planning to address future life cycle support of these tools will be undertaken. An expansion of the core tool set to increase productivity of both government and industry programmers will also be started. In FY 1986, development of the expanded JOVIAL tool set will be completed, as will development of the Ada-to-MIL-STD-1750 code generator. This program will continue its support to the JOVIAL and MIL-STD-1750 users while transitioning and supporting the introduction of the Ada programming language.

D. (U) Project 2519, Generic Radar Improvements: This project supports development of generic radar improvements for current Air Force airborne fire control radar systems. It provides air-to-air/ground radar improvements to satisfy close air support/interdiction, air superiority, and strategic needs. Emphasis is on improving reliability and maintainability (R&M) and developing common mode capabilities among the F-15, F-16 and B-1B radar systems with minimum duplication of effort. In addition, this project coordinates radar development between the Air Force laboratories, the aircraft system program offices, contractors, and other users. During FY 1984 support continued to the F-15 Multi-Stage Improvement Program (MSIP) to incorporate gate array technology into the F-15 radar. This technology will facilitate use of standard computer architectures such as the MIL-STD-1750A 16-bit Instruction Set Architecture and the MIL-STD-1589B JOVIAL High Order Language. A study effort to assess the feasibility of incorporating a terrain following/terrain avoidance mode into the F-16 radar was completed. Contracts were awarded to Westinghouse Electric Corp. and Hughes Aircraft Corp. to collect and analyze R&M data on the F-16 APG-66 and F-15 APG-63 radars. This R&M data collection effort is part of a comprehensive F-15/F-16 Radar R&M Improvement Program aimed at improving the R&M of currently fielded radar systems. Finally, a radar investment strategy steering committee was established to help plan and focus current and future airborne radar development efforts. In FY 1985 the data collection and analysis phase for the F-15/F-16 Radar R&M Improvement Program will be completed and implementation of key recommendations will be initiated. In addition, applicability to future aircraft such as the Advanced Tactical Fighter, will be determined. An effort to develop a common electronic counter-countermeasures (ECCM) threat data base based on technical baseline information obtained from F-15 testing will be initiated. Support will continue to the F-15 MSIP radar effort. As part of the Radar Investment Strategy activity, an airborne radar development roadmap will be developed. During FY 1986 implementation of key recommendations from the F-15/F-16 Radar R&M Improvement program will continue. In addition, a component improvement program using Environmental Stress Screening will be initiated based upon radar R&M recommendations. Development of a common ECCM threat data base will be continued and coordinated with the Air Force's ECCM Master Plan. An effort to develop a standard High Speed Data Bus to support advanced radar concepts will be initiated. Finally, an effort to develop a radar engineering development model to demonstrate integration of advanced technologies such as VHSIC (Very High Speed Integrated Circuits), HSDB, an electronically

scanned antenna, a common signal processor, and advanced electronic counter-countermeasures techniques will be initiated. This project will continue efforts to identify and fund development activities that have generic application to Air Force airborne radar systems.

E. (U) Project 2560, JOVIAL Language Control Facility: This project supports the JOVIAL Language Control Facility (LCF), a service organization established by the language control agent to insure the stability and configuration of the JOVIAL language. The LCF provides control and maintenance of standard language definitions, control of standard compilers, and compiler validation testing. In addition, the LCF provides both government and industry users advice and assistance in using and implementing JOVIAL. It is estimated that under full operation the JOVIAL LCF saves the Air Force $15 million a year in compiler acquisition costs alone. During FY 1984, MIL-STD-1589B, the JOVIAL High Order Language, was revised and version C was published. Further, the LCF validated 12 compilers for compliance with the MIL-STD, participated in three JOVIAL/Ada Users Group meetings, conducted six JOVIAL training classes and published the JOVIAL LCF Newsletter. During FY 1985 the JOVIAL Language Control Facility (LCF) will continue to resolve JOVIAL language issues. It also will validate approximately 18 compilers, continue to support users group meetings, and conduct JOVIAL training classes. The program support library, a JOVIAL programming aid, will be considered for rehosting to a VAX computer system. During FY 1986 efforts to maintain and control MIL-STD-1589C will continue. All new JOVIAL compilers will be validated for conformance to this standard. Training and participation in government/industry forums will also continue. This ongoing program will continue to validate new JOVIAL compilers while maintaining and controlling the JOVIAL High Order Language.

F. (U) 2658, Avionics Architecture Implementation and Support: This project supports the System Engineering Avionics Facility which provides for the development and support of avionics architectural standards such as MIL-STD-1553B and MIL-STD-1750A. It carries out necessary validation testing and provides consultation and engineering support for development and support of new and existing avionics architectural standards. In addition, the project also supports standardized avionics development efforts such as the Standard Central Air Data Computer and the Air Force Standard Inertial Navigation Unit. Applicable new technologies are also investigated and appropriate new standards developed as required. During FY 1984 validation/verification of implementations of MIL-STD-1553B (26 Systems) and MIL-STD-1750A (10 Systems) were performed. A MIL-STD-1553B handbook was published and we completed the development of MIL-STD-1750A automated verification software. This program also assumed overall Air Force responsibility for developing verification procedures for the MIL-STD-1760 Aircraft/Stores Electrical Interconnection System. An effort to assess fiber optics technology for application to a High Speed Data Bus was also initiated. In FY 1985 a test standard for MIL-STD-1553B verification/validation will be completed. This standard will enable MIL-STD-1553B validation testing to be transitioned to industry. MIL-STD-1750 automated verification software will be enhanced. MIL-STD-1553B and 1750A verification/validation activity will continue as will the MIL-STD-1760 work. In FY 1986 an update of the MIL-STD-1553B handbook will be initiated. MIL-STD-1760 development will be completed and development of a MIL-STD-1760 handbook will be started. MIL-STD-1553B and 1750A verification/validation activity will continue. This ongoing support program will continue to certify avionics compliance with MIL-STDs-1553B, 1750A and 1760.

G. (U) Project 2993, Digital Audio Distribution System (DADS): The DADS program is a Tri-Service Joint Services Review Committee effort, with funding shared equally among the three services, aimed at developing a standard aircraft audio intercom system able to meet both present and future aircraft needs. Candidate aircraft include the F-4, F-111, F-15, F-16, A-10, OV-10, T-46A, EC-130, C-141, C-17, E-3A, E-4A, HH-53, E-2C, F-14, E-6A, A-6F, JVX, CH-47D, AH-64, LHX, and other future aircraft to be determined. The effort will include development of headsets and microphones, intercom units, wiring, and data. Primary objectives are to provide improved reliability, reduced ambient noise levels, and higher quality audio reproduction over present systems. In addition, the system will be designed to meet TEMPEST and nuclear hardening requirements, and be compatible with future secure voice, voice recognition and response, data entry, and digital communication systems. A standard design will minimize proliferation of units and permit reduced development and support costs. In FY 1984, Full Scale Development contracts were awarded to Telephonics Corp. and Magnavox Corp. Preliminary brassboard development (Phase I) was also initiated. In FY 1985 preliminary design and evaluation (Phase I) will be completed. Preliminary Design Review and Critical Design Review are scheduled for January and June 1985 respectively. Development of preproduction models (Phase II) will be accomplished and qualification and flight testing will begin. During FY 1986 Phase II will be completed and Air Force Development Test and Evaluation and Operational Test and Evaluation will start. A production contract award is currently scheduled for FY 1987 with initial deliveries scheduled to begin in FY 1988.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64209F
DOD Mission Area: #225 - Air Warfare Support

Title: F100 Durability
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		35,200	14,003	2,899	0	0	*52,102

*FY 1983 and prior funds included under PE 64223F, Alternate Fighter Engine.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for continuation of the full scale development of the Digital Electronic Engine Control (DEEC), engine monitoring system (EMS), gear-type main fuel pump and associated organizational and intermediate level support equipment for the Pratt & Whitney Aircraft (P&WA) F100-PW-220 engine. Development and qualification of the DEEC, EMS, and gear pump are essential to support the final configuration of the P&WA candidate in the Alternate Fighter Engine (AFE) competitive acquisition program which will result in procurement of durable, supportable, affordable engines for the F-15 and F-16 fighter fleets. Effort includes development and qualification of the gear pump with a bypass valve for F100-PW-200/F-16 safety and durability improvement. This program is budgeted at the most likely cost and does not differ materially from known contractor estimates.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	32,500	14,003	2,954		0	49,475

(U) The increase of $2.7 million in FY 1984 reflects a more accurate accounting of tasks associated with DEEC/ gear pump development than was available in the original estimate. Funds for creation of the F100 Durability program element were administratively seperated from funds contained in the Alternate Fighter Engine program (PE 64223F) by Congressional direction in FY 1984. The reduction in FY 1986 funding results from application of updated inflation factors.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable. Funds required to implement competitive procurement are included in F-15 (PE 27130F) and F-16 (PE 27133F) programs.

5. (U) RELATED ACTIVITIES: This program continues the full scale development of the DEEC/gear pump that was funded under the AFE program (PE 64223F) during FY 1982 - 1983. By Congressional direction beginning in FY 1984, this effort was administratively separated from the AFE program. The F100 Component Improvement Program (part of PE 64268F,

Aircraft Engine Component Improvement Program) also contains tasks to improve the durability characteristics of F100 engines.

6. (U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The DEEC/EMS/gear pump development is being conducted by Pratt & Whitney Aircraft, Government Products Division, West Palm Beach, FL.

7. (U) SINGLE PROJECT WITH LESS THAN $10 MILLION IN FY 1986:

(U) PROJECT: PE 64209F, F100 Durability

A. (U) Project Description: In FY 1982, the Digital Electronic Engine Control (DEEC) transitioned from an Engine Model Derivative Program (PE 64218F) demonstrator effort to full scale development under the Alternate Fighter Engine (AFE) program (PE 64223F). The DEEC provides the F100 engine with enhanced operability and substantially reduced support costs as well as deleting the requirement to trim the engine. The Pratt & Whitney Aircraft F100-PW-220 entry in the AFE competition combines these operability features with an increased life core to produce an engine with more than twice the durability of today's F100 engines in F-15 and F-16 aircraft. Maintenance will be enhanced by an engine monitoring system (EMS) for diagnostics. The gear-type main fuel pump is being developed as a safety enhancement for retrofit in F-16/F100 engines already in the field as well as for use with DEEC equipped F100-PW-220 engines.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The qualification testing of the DEEC/gear pump, and gear pump with bypass valve on F100-PW-200 engines was completed for F-15 and F-16 applications. Lead-the-force evaluation of the design, prototype fabrication, and test of intermediate and organizational support equipment continued. Development testing of the DEEC/gear pump on the F100-PW-220 engine at sea level, altitude, and accelerated mission testing (4100 Total Accumulated Cycles) was completed. Anti-ice testing was successfully completed.

(2) (U) FY 1985 Program: The program will continue with qualification and production verification of the F100-PW-220 engine in sea level, altitude, and accelerated mission testing. Production integration and flight testing will be accomplished with pre-production prototype engines in F-15 test aircraft. Design and test of the Engine Monitoring System and related support equipment will continue. Continued development of technical data will result in completion and verification of engine and aircraft technical orders. Training program development will be completed. This year a field service evaluation of DEEC/gear pump equipped F100 engines in F-15 aircraft will be initiated for the purpose of operationally evaluating and validating the control system maintenance concept, technical data, support equipment, operations characteristics, and spares provisioning requirements. Cold start testing will be completed to affirm cold weather operations capability. Tooling for F-15 production changes required for the F100-PW-220 will be designed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In FY 1986 the remaining flight test of new production F100-PW-220 engines in a new production F-15 C or D aircraft will complete the qualification and production verification testing of the -220 engine. Testing and qualification of the Engine Monitoring System and related support equipment will be completed. Validation of -220 and F-15 C/D tech data will begin. Testing and qualification of the system design to integrate the Engine Monitoring System output (time/cycle date, diagnostics, trend data) with intermediate base and logistics data systems will be completed. Source data development for design of depot support equipment will be completed. This program is based on a Category II cost estimate.

(4) (U) Program to Completion: This program ends in FY 1986. Any residual effort required during FY 1987 and later will be accomplished under the companion program, F100 Component Improvement Program (part of PE 64268F).

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Production Verification Accelerated Mission Testing	February 1985
(2) (U) Production Verification Altitude Testing	March 1985
(3) (U) Production Verification Sea Level Testing	April 1985
(4) (U) Production Integration Flight Test (F-15)	August 1985
(5) (U) Production Verification Flight Test (F-15)	July 1986
(6) (U) First Production Engine Delivery	November 1985
(7) (U) First F-15 C/D Delivery w/-220 Engine	December 1986

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64212F
DOD Mission Area: 225 - Air Warfare Support

Title: Aircraft Equipment Development
Budget Activity: 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		5,811	6,000	8,779	17,110	Continuing	N/A
1926	Aircraft Windshield Development	1,714	1,481	1,960	2,446	Continuing	N/A
2098	Aircraft Accessories Development	1,658	1,442	2,362	3,490	Continuing	N/A
2377	Airdrop Systems Support	204	284	372	520	Continuing	N/A
2709	Integrated Turbine Engine Monitoring System	811	1,306	2,361	8,714	49,847	63,132
4366	Integrated Attack Avionics	1,424	1,487	1,724	1,940	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Due to changing threat scenarios, equipment obsolescence and technical advancements, a need exists to update and modernize the aircraft force. A need also exists to correct deficiencies that exist in operational aircraft in the areas of safety and systems effectiveness. This program element represents a collection of different but related projects which develop, test, and evaluate a variety of aircraft subsystem equipment to respond to these operational needs. Technological advancements in aircraft equipment are exploited and/or translated into operational hardware. This also is the only engineering development program element which utilizes advanced state-of-the-art technology to develop windshield systems offering improved bird strike hazard resistance and reduced cost-of-ownership.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	7,680	12,047	16,972		Continuing	N/A

FY 1984 reduction of $1.9 million was by Congressional action. The FY 1985 reduction of $6.047 million reflected Congressional action. The FY 1986 request is reduced due to other budget priorities.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Programs are transitioned from Program Elements 62201F, Aerospace Flight Dynamics; 63211F, Aerospace Structural Materials; and 63203F, Advanced Avionics for Aircraft, to this program to complete engineering development required to introduce equipment into the operational inventory.

Program Element 64201F, Aircraft Avionics Equipment, is a related and closely coordinated effort that accomplishes the bulk of the engineering development of avionics systems. A relationship between the Aircraft Equipment Development program and PE 78026F, Productivity, Reliability, Availability, and Maintainability (PRAM) program, also exist. This program has as one of its goals the reduction of weapon systems ownership costs through development of aircraft equipment with a minimum life cycle cost.

6. (U) WORK PERFORMED BY: Program management is provided by the Air Force Aeronautical Systems Division and Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH; the Air Force Flight Test Center, Edwards Air Force Base, CA; Arnold Engineering and Development Center, Tullahoma, TN; Tactical Fighter Weapons Center, Nellis Air Force Base, NV; and the Armament Development and Test Center, Eglin Air Base, FL. Contractors include McDonnell Douglas Corporation, Long Beach, CA, and St. Louis, MO; General Dynamics, Fort Worth, TX; Hughes Aircraft Company, Culver City, CA; B.F. Goodrich, Akron, OH; Sierracin Corporation, Sylmar, CA; Pittsburgh Plate Glass Company, Pittsburgh, PA; Honeywell Incorporated, Minneapolis, MN; Bendix Corporation, South Bend, IN; Goodyear Aerospace Corporation, Akron, OH; and Dunlop Limited, Coventry, England.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 1926, Aircraft Windshield Development. Aircraft Windshield Development applies the latest technology to achieve bird impact resistance while maintaining high optical quality and light weight. F-111 bird impact resistant windshields were developed in this project. Current efforts are concentrating on the F-16, F-15, T-38, F-4, and A-7 aircraft. In FY 1984 this project continued development, test, and evaluation of windshield lamination and canopy structures on the F-16, F-4, and T-38. FY 1985 will be a continuation of efforts on the above aircraft. Work on the F-15 windscreen for concerns raised on bird strikes during low altitude operations and rainbow effects on the B-1B windscreens will continue. All efforts are expected to improve combat capability, pilot safety, and reduce cost. The FY 1986 program will continue work of FY 1985 and concentrate on Advanced Tactical Fighter windshield requirements. Work on combat hardening of windshields will also be an area of primary interest.

B. (U) Project: 2098, Accessories Development. Aircraft Accessories Development applies technological improvements to aircraft landing gears in the areas of high temperature wheels and brakes and carbon disc brakes in an effort to improve safety factors and performance, decrease acquisition costs, and reduce operation and support costs. FY 1984 efforts were directed to support the Joint Logistics Commanders' work on a domestic source of natural rubber through cultivation of Guayule plants in the Southwest United States. Efforts on standardization of aircraft fasteners continued. Work continued to develop an isolated hydraulic system for aircraft landing gears to permit use of hydraulic fluids with greater fire retardation capabilities. Work on evaluation and comparison of a hydrazine fueled engine starter and an improved solid fueled engine starter was initiated. FY 1985 efforts will continue in these areas with increased emphasis in the Guayule rubber effort and the work on the starter cartridge. The FY 1986 program

will include the above efforts. Evaluation of starter cartridges is programmed for completion. Work on technological improvements to landing gear systems in the areas of high temperature wheels, brakes, and carbon disc brakes for better safety, performance, acquisition, operation, and support costs will be pursued as a continuing effort.

C. (U) Project: 2377, Airdrop Systems Support. Airdrop Systems Support provides the method by which the United States Air Force carries out its responsibilities as executive agent (designated by the Joint Technical Airdrop Group) for development and testing of onboard airdrop systems. Efforts in FY 1984 continued support of the computation of airdrop release point parameters on new airdrop subsystems, and support to the Military Airlift Command and Army in development of improved airdrop systems. FY 1985 work will continue the efforts in the above areas. The program will also be addressing required development of an improved cargo gate release system and containerized cargo handling systems. FY 1986 work will continue the efforts begun in FY 1985. Work on items recommended by the Joint Technical Airdrop Group (JTAG) will continue. Work on the containerized delivery system and gate release mechanism is programmed for delivery to the Military Airlift Command.

D. (U) Project: 2709, Integrated Turbine Engine Monitoring System. The Integrated Turbine Engine Monitoring System provides for development of a generic system to monitor real-time engine operating data for electronic processing and storage on board the aircraft for inflight readout and post flight review. Outputs will be used to improve maintenance and engine performance data base files and provide flight crews data for inflight operational decisions. Techniques and hardware developed in the A-10 Turbine Engine Monitoring system will be employed as part of the firmware and software developed by project 2709. FY 1984 marked the beginning of Phase I of the effort. Source selection of four contractors was completed. Preparations for negotiations were completed to allow release of contracts in FY 1985. The FY 1985 program will include conceptual design work, development of specifications and standards, and performance evaluations of breadboard systems. The FY 1986 program will complete Phase I and initiate Phase II. Phase II will develop engineering design work and prepare Requests for Proposals (RFPs) for the planned system. Contracts to complete Phase II will be released with a projected completion of full-scale development in FY 1989 with a program goal to deliver a system for integration on the Advanced Tactical Fighter (ATF) and other potential aircraft.

E. (U) Project: 4366, Integrated Attack Avionics. Integrated Attack Avionics integrates and tests the latest developments in the avionics/weapons areas to develop interface techniques which will assure optimum weapon delivery in high performance aircraft. This project provides for (a) the feasibility demonstration and qualification testing of a compact airborne video recorder (CAVR); (b) a feasibility demonstration of a solid-state color cockpit video sensor (CCVS) capability suitable for tactical aircraft use, with planning and investigation for full-scale development, production, and aircraft integration. Work on a split screen video compression (SSVC) interface has been transferred to the F-16 and F-15 programs for inclusion in their design improvement efforts. The FY 1984 program consisted of initial flight tests of the compact airborne video recorder. These tests were completed and results are under review. Deficiencies in design and packaging have been provided to the contractors for resolution. Ground

testing of the color camera was completed and required design changes are being developed. The FY 1985 program will develop and release RFPs for full-scale development and production. Corrections to breadboard designs will be evaluated. Integration criteria for application of the compact airborne video recorder to the FB-111 under the Avionics Modernization Program will be conducted. FY 1986 program will deliver production hardware to the FB-111 for Developmental Test and Evaluation/Initial Operational Test and Evaluation. Work on the color camera will continue with completion programmed in FY 1988.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64218F
DOD Mission Area: #225 - Close Air Support and Interdiction

Title: Engine Model Derivative Program (EMDP)
Budget Activity: # 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		57,853	82,698	122,854	99,009	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Engine Model Derivative Program (EMDP) is an engineering development program established to provide existing air vehicle systems with the latest advances in engine technology and to provide a framework for engine development for future systems. EMDP contributes to system life extension, reduced life cycle cost and enhanced performance characteristics to counter increases in system weight and/or increased threat capability. EMDP demonstrates derivative engine concepts that incorporate demonstrated technology and advanced components from government funded programs and contractor Independent Research and Development (IR&D). EMDP demonstrates technologies in the areas of performance, durability, operability, supportability, reliability, maintainability and other unique capabilities (e.g., thrust reversing/vectoring nozzles) in prototype engines prior to full scale development.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	58,513	9,198	21,950		Continuing	N/A

(U) Changes in funding in FY 1985 and FY 1986 represent the program to fund higher performance versions of the F100-PW-220 and F110-GE-100 engines as approved by Congress. This program is an integral part of the Tactical Fighter Roadmap where higher thrust engines would be made available for incorporation into F-15/F-16 aircraft by 1990. This work is a continuation of the program initiated by the $50 million Congressional add-on in FY 1984. The addition of $73.5 million in FY 1985 will fund both contractors (Pratt and Whitney, General Electric) for detailed engine design, test hardware procurement and component development. The addition of $100.9 million in FY 1986 funds component and development engine tests by both contractors leading to a full scale development decision in FY 1986.

(U) The $50 million FY 1984 add-on allowed a rephasing of the EMDP program for FY 1985 and FY 1986 to include the directed development of higher thrust F100 and F110 derivatives. In addition, a new effort to develop an improved J402 (Harpoon Missile) engine will be started in FY 1985. The J402 work takes advantage of a unique window of opportunity and will be funded at $2.0 million in FY 1985. The total funded program for the J402 will be $10.0 million. The Air Force intends to officially notify the Congress of this below-threshold new start in early 1985. Release of the $50 million occurred after the submission of the FY 1985 Descriptive Summary and as a result the J402 EMD program was not mentioned.

Program Element: #64218F
DOD Mission Area: #225 - Close Air Support and Interdiction

Title: Engine Model Derivative Program (EMDP)
Budget Activity: #4 - Tactical Programs

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: For the requisite technology, this program draws gas generator "core" engine technology (high pressure compressor, combustor, and high pressure turbine) from Program Element (PE) 63216F, Advanced Turbine Engine Gas Generator (ATEGG). Fan, low pressure turbine and limited engine test data are provided by PE 63202F, Aircraft Propulsion Subsystems Integration (APSI). Advanced component technology is also obtained from PE 62203F, Aerospace Propulsion. Other principal inputs including materials processing and component fabrication demonstration come from PE 78011F, Industrial Preparedness Program. Activities conducted by the Navy, National Aeronautics and Space Administration, the Army and propulsion industry in-house programs also constitute significant sources of technology. The Air Force and the Navy have a broad memorandum of understanding for joint cooperative propulsion programs in areas of common interest. Component Improvement Program efforts directed toward engine flight safety problems, service revealed difficulties and the achievement of durability goals also complement the long term EMDP development process.

6. (U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The contractors involved are: Pratt and Whitney Aircraft, Government Products Division, West Palm Beach, FL, (F100 engine), the General Electric Company, Evendale, OH, (F110 engine), and Teledyne CAE, Toledo, OH, (J402 engine).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: PE 64218F, Engine Model Derivative Program (EMDP)

A. (U) Project Description: The capability provided by the EMDP, when combined with new engine developments, will ensure that the Air Force has propulsion alternatives for near term and far term needs. The only other means today of providing this capability is through full scale weapon system development. The EMDP will conduct the early engineering development leading to a prototype derivative of an existing engine. This early demonstration of improved engine characteristics (i.e., performance, operability, durability, reliability, maintainability and life cycle cost) reduces risk and shorten the time necessary to fully develop and qualify an engine, thus providing a more immediate response to potential weapon system needs. Full scale development would be conducted in a separate development program after validation of a requirement for increased weapon system performance. Specific tasks in the current EMDP are as follows: (Note: Items (1), (3) and (4) are an integral part of the Tactical Fighter Roadmap plans for higher performance engines to be qualified in CY 1989 for CY 1990 F-15/F-16 aircraft).

(1) F100 EMDP - Demonstrate an increased performance F100 engine having 4,000 total accumulated cycles (TAC) durability as well as improved operability, reliability, maintainability and reduced life cycle cost. This engine configuration consists of the Increased Life Core developed in the Component Improvement Program, an increased air flow fan, an advanced augmentor and an improved low pressure turbine.

(2) J402 EMDP - Demonstrate an improved Harpoon Missile engine having 25% more thrust, 22% better specific fuel consumption and 10% lower unit cost, while maintaining current levels of durability and reliability.

(3) F100 Increased Performance - Demonstrate a higher thrust F100 engine having Alternate Fighter Engine (AFE) levels of durability, operability, reliability and maintainability. A potential engine configuration includes an increased efficiency compressor and floatwall combustor, plus the fan, augmentor and low pressure turbine from the F100 Engine Model Derivative Program (EMDP) described above.

(4) F110 Increased Performance - Demonstrate a higher thrust F110 engine having AFE levels of durability, operability, reliability and maintainability. A potential engine configuration includes a higher airflow core, digital engine control and improved low pressure turbine.

(5) EMDP Initiatives - There are four additional initiatives planned: A T56 Gearbox Improvement for the C-130 aircraft to demonstrate an increased performance gearbox to take full advantage of the power available from the advanced T56 engine currently in development; an advanced turboprop engine to meet requirements of the late 1990's; an advanced trainer/attack engine for attack versions of the T-46 aircraft; and an afterburning TF41 to demonstrate a higher thrust engine for A-7 aircraft in order to improve maneuverability, survivability, payload capacity and shorten take-off requirements.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments:

(a) F100 EMDP - The F100 EMDP was the sole EMDP effort under contract. Major accomplishments included completion of over 240 hours of altitude testing and a 2000 cycle Accelerated Mission Test (AMT) using the Increased Life Core from the F100-PW-220 design and an advanced fuel management augmentor. Over 40 hours of sea level development testing was performed on the EMDP configuration to evaluate design modifications made to the fan and augmentor assemblies. Development hardware procurement continued in support of planned altitude and AMT testing on the final EMDP configuration in FY 1985.

(b) J402 EMDP - Pre-contract award activities were accomplished which will lead to contract award in May 1985.

(c) F100 and F110 Improved Performance EMDP - These programs were initiated with a $50 million ($25 million each) Congressional add-on. Due to late (August 1984) release of the Congressional add-on, the $50 million was forward-financed into FY 1985. FY 1984 activities included pre-contract award tasks; e.g., request for proposal (RFP) preparation, leading to contract award in the February 1985 timeframe.

(2) (U) FY 1985 Program:

(a) F100 EMDP - F100 EMDP will end with the completion of a 4000 cycle Accelerated Mission Test (AMT). Over 200 hours of altitude testing will be conducted to evaluate the performance and operability of the final EMDP configuration. Engine development testing will be conducted to evaluate the fan anti-icing system and the full-life low pressure turbine assembly.

(b) J402 EMDP - Detail design tasks and component testing will be underway. Procurement and fabrication of the engine hardware will be initiated.

(c) F100 Increased Performance - FY 1985 tasks include detailed design of a floatwall combustor and a higher efficiency, stagnation resistant compressor, test hardware procurement and component development. These activities support a full scale development decision in FY 1986.

(d) F110 Increased Performance - Tasks to be accomplished in FY 1985 include detailed design of a high flow core and low pressure turbine (LPT), test hardware procurement, core and LPT component development and digital engine control development. These activities support a full scale development decision in FY 1986.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request:

(a) J402 EMDP - FY 1986 activities will include completion of detail design and component testing. Heavyweight engine testing will be conducted. Flightweight engine fabrication/testing will be initiated. This program is based on a Category IV cost estimate.

(b) F100 Increased Performance - Detail design and hardware procurement will be completed. Component testing will be accomplished. Sea level development engine tests will be conducted. This program is based on a Category IV cost estimate.

(c) F110 Increased Performance - Detail design and hardware procurement will be completed. Digital engine control development/testing will continue. Component development testing will be conducted. Sea level development engine testing will be initiated. This program is based on a Catagory IV cost estimate.

(4) (U) Program to Completion: The EMDP, by design, is a continuing effort as additional projects are identified.

(a) J402 EMDP - Demonstration of engine performance goals will be completed in FY 1987 with the completion of engine testing.

(b) F100 and F110 Improved Performance EMDP - These programs will end in FY 1988 with the conclusion of demonstration engine testing.

(c) EMDP Initiatives - Plans include initiation of additional programs starting in FY 1989.

C. (U) Major Milestones:

Milestones	Dates
(a) F100 EMDP	
4000 TAC cycle AMT complete	September 1985
(b) J402 EMDP	
Contract Award	May 1985
Engine Tests Complete	September 1987
(c) F100 Increased Performance	
Contract Award	February 1985
Demonstration Engine Testing Complete	December 1987
Flight Test Complete (Demonstration Engine)	March 1988
(d) F110 Increased Performance	
Contract Award	February 1985
Demonstration Engine Testing Complete	December 1987
Flight Test Complete (Demonstration Engine)	March 1988

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64219F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Integrated Digital Avionics
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0*	0*	11,763	19,598	Continuing	N/A

* Prior year funding for this effort is contained in program elements 64753F and 63203F.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Air Force combat rescue and special operations aircraft such as the HH-60A, HH-53 and Joint Services Advanced Vertical Lift Aircraft (JVX) require specialized avionics systems in order to perform their missions at night and in adverse weather conditions. A key component of these systems is a multi-mode radar (MMR) for terrain following and terrain avoidance flight. The initial thrust of this program is to continue efforts previously funded in program elements 64753F and 63203F to develop a multi-mode derivative of the Low Altitude Navigation Targeting Infrared System for Night (LANTIRN) radar. The development effort will then be expanded to include additional avionics systems (currently under evaluation by Air Force Systems Command) with similar potential for cost savings through multi-aircraft application.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: MMR development was initiated in program element 64753F (Combat Helicopter Modernization). When that program was restructured in FY 1984, MMR development was temporarily moved to program element 63203F (Advanced Avionics for Aircraft) for continuation as a generic effort. In FY 1986 the MMR development will be transferred to program element 64219F for completion. The Air Force and Navy versions of the JVX (program element 63256F/N) both require MMR.

6. (U) WORK PERFORMED BY: The Air Force management of this program is accomplished by the Air Force Systems Command Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The development contract for the multi-mode radar effort has been awarded to International Business Machines, Owego, NY.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: Integrated Digital Avionics

A. (U) Project Description: See paragraph 2.

B. (U) Program Accomplishments and Future Efforts: *

(1) (U) FY 1984 Accomplishments: Multi-mode radar (MMR) interface unit/systems integration began. Software development was continued. Assembly of test hardware was started. Software checkout in the System Integration Lab (SIL) was started.

(2) (U) FY 1985 Program: MMR integration and SIL testing will be completed. Fabrication of two flight worthy MMRs and two MMR system testers will be completed. MMR software testing will be completed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Efforts will begin to add weather and beacon modes to the MMR for incorporation in the Joint Services Advanced Vertical Lift Aircraft (JVX). Reliability growth/development testing and reliability design verification testing will be performed. MMR integrated logistics support tasks will be completed. Cost data is based on initial planning estimates.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: *

Milestones	Dates
(1) (U) MMR development initiated (program element 64753F)	October 1982
(2) (U) MMR Critical Design Review	June 1983
(3) (U) Dedicated MMR flight test begins	FY 1987
(4) (U) Complete MMR effort	FY 1988

* Air Force Systems Command is currently evaluating other projects with multi-aircraft application for possible inclusion in this program element.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64220F
DOD Mission Area: #372 - Escort, Stand-off & Counter Command, Control, and Communications

Title: Electronic Warfare Counter Response
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		27,462*	14,000	37,193	28,632	Continuing	N/A
2066	EF-111A Upgrade	11,962	14,000	37,193	28,632	Continuing	N/A
2687	OFT	15,500*	0	0	0	0	0

*Beginning in FY 1985 Project 2687, Operational Training was transferred to PE #64227F, Flight Simulator Development.

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The EF-111A Tactical Jamming System provides tactical jamming of early warning, acquisition, and ground control intercept radars in support of United States and Allied Tactical Strike Aircraft operations. It denies hostile command and control nets the input from surveillance radars forcing hostile fire control systems into autonomous and less optimum modes of operation; reducing their efficiency and effectiveness. The EF-111A Tactical Jamming System is an essential element of the tactical defense suppression "mix" of destructive and disruptive systems needed to permit effective air operations against enemy mobile ground attack forces and fixed support assets protected by a massive air defense system. The EF-111A provides the[

] By denying acquisition range, azimuth, and altitude information required by surface-to-air missiles (SAMs), anti-aircraft artillery (AAA) and airborne interceptors (AI), the EF-111A effectively degrades their defensive capabilities and provides necessary support jamming to United States Air Force tactical fighters and the[

] This program provides the research, development, test, evaluation and integration of software and hardware updates to aircraft electronic countermeasures subsystems to maintain system currency with the evolving and predicted threats.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	28,903	23,917	36,293	Continuing	N/A
Aircraft Procurement	2,900	25,400	3,400	Continuing	N/A

Program Element: #64220F

DOD Mission Area: #372 - Escort, Stand-off & Counter Command, Control and Communications

Title: Electronic Warfare Counter Response

Budget Activity: #4 - Tactical Programs

EXPLANATION: (U) The EF-111A Upgrade project absorbed $1.446 million of the $5.0 million FY 1984 RD[illegible] Congressional reduction. For FY 1985, reflects a $9.9 million Congressional RDT&E reduction; $23.4 million i[illegible] procurement funds for the Operation Flight Trainers (OFT) were transferred to the Flight Simulator Development program (PE 64227F). The RDT&E funding reduction in FY 1985 is causing a program restructure. Planned procurement of minor improvements in FY 1984, 1985 and 1986 have been deferred and included with the major update funding.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:							
Funds* (PE 27252F)		0	0	0	26,200	160,800	187,000
Quantities	Proc				1	37	
	Del					38	

*Includes Modification and Initial Modification Spares

5. (U) RELATED ACTIVITIES: Program Element 27252F, EF-111A Squadrons, funds the Class V modification kit procurement and military construction associated with the EF-111A Tactical Jamming System. This program element also procures the second Operational Flight Trainer, which will be located at RAF Upper Heyford, UK. Program Element 63718F, Electronic Warfare Technology, funds advanced development efforts for a high powered jamming system. Program Element 72207F, Depot Maintenance, funds the installation of the EF-111A Tactical Jamming System. Program Element 64227F, Flight Simulator Development, funds development of Initial Operational Flight Trainer, which will be located at Mountain Home AFB, ID.

6. (U) WORK PERFORMED BY: The prime contractor for the EF-111A Upgrade program is Eaton Corporation, AIL Division, Deer Park, Long Island, NY. The principal subcontractors are: Tasker Digital Radio Frequency Memory (DRFM), Whitaker Corp, Systems Division, Simi Valley, CA; Delco (processor), General Motors, Systems Operations, Goleta, CA; Comptek Research Inc. (software), Buffalo, NY; General Dynamics (integration), Fort Worth, TX. The development effort will be managed by Aeronautical Systems Division (ASD) WPAFB, OH, and the installation will be accomplished by Sacramento Air Logistics Center, Sacramento, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2066, EF-111A Upgrade

Program Element : #64220F
DOD Mission Area: #372 - Escort, Stand-off & Counter Command, Control and Communications

Title: Electronic Warfare Counter Response
Budget Activity: #4 - Tactical Programs

A. Project Description: Update to the EF-111A is required to keep the tactical jamming system current against the evolving threat. Since the 1974 design cut-off point for the original jamming suite,

The update program will incorporate a new multiple processing encoder, a 1750 computer, 1533B data bus, two reprogrammable exciters, and a new narrow band 7/8 antenna and software changes to allow the system to defeat the threat by placing concentrated jamming through improved power management on the radars of interest.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Source selection for EF-111A upgrade was completed and based upon competitive bids, the upgrade contract was awarded to EATON Corporation, AIL Division on 3 Oct 84.

(2) (U) FY 1985 Program: Funding during this fiscal year will provide for full scale development efforts for the EF-111A Upgrade. In addition to preliminary/critical design reviews and a brassboard demonstration, fabrication and assembly of six preproduction kits will be initiated. During the last quarter, component testing will commence.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Funding begins fabrication of full scale development kits, initiates reliability testing, and starts integrating development kits into aircraft for flight testing. Preparations for Development Testing and Initial Operational Testing and Evaluation will begin as will the start of contractor flight testing. Cost modeling techniques (including the RCA PRICE model) were used to establish cost estimates and are considered equivalent to confidence level III. Contracting strategy for the full scale development was open competition for a fixed price incentive fee contract with production options.

(4) (U) Program to Completion: Environmental, reliability growth, and performance testing and DT&E flight test will complete in FY 1987. This is a continuing program. Kit production will begin in FY 1987. Deliveries and installation will continue until FY 1989.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Update Contract Award	October 1984
(2) (U) Preliminary Design Review	February 1985
(3) (U) Critical Design Review (Hardware)	July 1985
(4) (U) First Preproduction Kit Delivery	January 1986
(5) (U) DT&E Flight Test Begins	June 1986
(6) (U) Production Decision	3rd Qtr FY 1987

These dates could change based on a program restructure.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64222F
DOD Mission Area: #242 - Theater Wide Nuclear Warfare

Title: Nuclear Weapons Support
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,912	1,947	2,035	2,076	CONTINUING	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides funds for salaries of the Air Force Weapons Laboratory cadre of civilian nuclear weapon specialists who provide technical guidance to the Department of Energy and direction to the North Atlantic Treaty Organization (NATO) for fulfillment of United States Air Force responsibilities related to the development and support of nuclear weapon systems. Includes funds to demonstrate weapon/warhead compatibility to delivery platforms. Supports Strategic Air Command Required Operational Capability 16-71 (Peacekeeper), 12-76 (Air Launched Cruise Missile), 6-76 (B61 Strategic Bomb), 6-69 (B83 Modern Strategic Bomb), and Tactical Air Force Statement of Operational Need 304-77 (Ground Launched Cruise Missile).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,912	1,947	2,080		CONTINUING	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Acquisition *
B61
B83
Maintenance and Evaluation *
B61
B83

* Department of Energy Funded

PE #: 64222F

(575)

Program Element: #64222F   Title: Nuclear Weapons Support
DOD Mission Area: #242 - Theater Wide Nuclear Warfare   Budget Activity: #4-Tactical Program

5. (U) RELATED ACTIVITIES: Activities which are related to the warhead development in this program element (PE) include PE 64312F (Peacekeeper), PE 64361F (Air Launched Cruise Missile), PE 64362F (Ground Launched Cruise Missile), and PE 63319F (Advanced Cruise Missile Technology). Activities related to nuclear weapon carrier modification/upgrade include PE 11113F (B-52 Offensive Avionics System), PE 11115F (FB-111B/C), PE 11118F (Short Range Attack Missile), PE 11213F (Minuteman Squadrons), PE 64226F (B-1B), and PE 11126F (B-1B).

6. (U) WORKED PERFORMED BY: Work is managed and primarily performed by the Air Force Weapons Laboratory, Kirtland AFB NM. Flight testing associated with the B83 and B61 programs is performed at the Air Force Flight Test Center, Edwards AFB, CA, employing both Air Force Systems Command and Strategic Air Command aircraft assets. An Air Force Weapons Laboratory operating location at Ramstein Air Base, Federal Republic of Germany, monitors all work on the multinational Tornado aircraft.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 64222F, Nuclear Weapons Support

A. (U) Project Description: Activities conducted under the program include nuclear weapon development, nuclear weapon/delivery platform and support equipment compatibility demonstration, and nuclear weapon data development and evaluation efforts. Nuclear development programs include the B83 and B61-3/4 gravity bombs, the W87 Peacekeeper, the W80 Air Launched Cruise Missile (ALCM), and the W84 Ground Launched Cruise Missile (GLCM) warheads. Weapon parachute development flight tests in support of both new weapons and upgraded older weapons are also supported. Compatibility efforts include maintaining nuclear certification of U.S. and North Atlantic Treaty Organization nuclear systems, providing for the development of nuclear weapon practice bombs, and maintaining and updating all nuclear weapon related Technical Orders.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Warheads in support of the GLCM Initial Operational Capability (IOC) were delivered to Greenham Common, UK and to Comiso, Sicily. The B83 IOC was achieved in Dec 1983. The Stockpile Confidence Test (SCT) of the W84 was detonated in [ ] Production peg points have been achieved for the B61-3/4 and B83 gravity bombs and for the W80 ALCM and W84 GLCM warheads. Retirement of the B57 gravity bomb continues on schedule. The W25 Genie completed retirement by the end of the year.

(2) FY 1985 Program: Continued production and deployment of the B61-3/4, W80, B83, and W84 will occur. Towards the latter part of the year, the Short Range Attack Missile II Project Officers Group should be formed as this warhead development completes Phase 2 (Feasibility Study). The Stockpile Confidence Test of the B83 was conducted in [ ] at the Nevada Test Site. The B61-7 (Stockpile Improvement Program version of the B61-1) will be produced. Production of the B28 Stockpile Improvement Program field retrofit kits will continue.

Program Element: #64222F
DOD Mission Area: #232 - Theater Wide Nuclear Warfare

Title: Nuclear Weapons Support
Budget Activity: #4-Tactical Programs

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Nuclear weapon development and production support continues. Continued engineering development of the Short Range Attack Missile (SRAM) II will be supported. The first W87 production warheads will be delivered to support the Peacekeeper Initial Operational Capability. Production and deployment of the B61-3/4 and B83 gravity bombs and the W80 Air Launched Cruise Missile and W84 Ground Launched Cruise Missile warheads continues.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	First delivery W84	November 1983
(2)	(U)	First delivery B83	December 1983
(3)		W84 Stockpile Confidence Test	
(4)		B83 Stockpile Confidence Test	
(5)		First Delivery B61-7	
(6)	(U)	SRAM II Enters Engineering Development	March 1986

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64223F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Alternate Fighter Engine
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		91,965	54,943	33,353	176,723	248,438	693,875

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides funds to complete full scale development (FSD) of the F110-GE-100 engine in FY 1986 (previously F101 Derivative Fighter Engine (DFE) under PE 64218F, Engine Model Derivative Program (EMDP)), as well as development and integration of configured engine bays in both F-15 and F-16 aircraft (provides capability to accept either F110 or F100 engines). Supports the competitive acquisition of durable, supportable, and affordable fighter engines for the expanding F-15 and F-16 fighter fleets beginning with the FY 1986 aircraft/engine deliveries. This program element also provides FSD funds for increased performance F100 and F110 engines in support of the Tactical Fighter Roadmap. The increased performance engine programs lead to engine qualification in October 1989 for delivery in CY 1990.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	94,955	56,943	14,687		0	301,201 *

* $39,405 of this supports F100 Digital Electronic Engine Control and gear pump development which by Congressional direction was funded under a separate program element, 64209F, "F100 Durability", beginning in FY 1984.

(U) Net addition of $18.666 million in FY 1986 results from: (1) addition of funds for development and integration of a configured engine bay in F-15 aircraft; and (2) addition of funds to continue development and qualification of increased performance F110 and F100 engines (begun under EMDP) for installation in F-15 and F-16 aircraft by 1990 to meet the improved threat at that time. Total estimated cost reflects the remaining additional $425.161 million necessary to complete development and integration of the configured engine bay in the F-15, and to qualify and integrate increased performance F110 and F100 engines in F-15 and F-16 aircraft.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Not Applicable. Funds required to implement competitive procurement of engines are included in F-15 (PE 27130F) and F-16 (PE 27133F) programs.

5. (U) RELATED ACTIVITIES: This program continues the development of the F101 Derivative Fighter Engine (DFE) which was initiated under PE 64218F, Engine Model Derivative Program (EMDP). The EMDP on the F101 DFE was conducted under a Memorandum of Understanding with the Navy. The pre-full scale development (FSD) of higher performance F100 and F110 engines is being performed in the Engine Model Derivative Program (EMDP), PE 64218F.

6. (U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The F110 and higher performance F110 programs are being conducted by the General Electric Company, Evendale, OH. The higher performance F100 engine program is being conducted by Pratt and Whitney Aircraft, Government Products Division, West Palm Beach, FL.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: PE 64223F, Alternate Fighter Engine (AFE)

A. (U) Project Description: The F110 was one of the first programs included in the Engine Model Derivative Program (EMDP). The F110-GE-100 is a fighter derivative of the B-1 engine, the F101. It consists of the same core engine as the F101 with fan and augmentor scaled from the F101 and F404 (Navy F-18 fighter) engines. The three year EMDP effort on the F110 was completed in FY 1981 with F-16 and F-14 flight tests. Engine test results reflect the design emphasis on reliability and durability. Altitude tests at Arnold Engineering Development Center (AEDC) and flight tests in F-16 and F-14 test beds confirm that the engine meets or exceeds predictions. F110 full scale development was initiated in FY 1982 and official qualification is scheduled to be completed by the end of January 1985. This program also includes development of configured engine bays for F-15 and F-16 aircraft that accept either the F110-GE-100 or the F100-PW-220. Beginning in FY 1986, FSD of increased performance F100 and F110 engines will be conducted. These engines will incorporate advanced technology to provide higher thrust while maintaining current AFE levels of durability, operability, reliability, maintainability and supportability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: On 3 February 1984, the F110-GE-100 engine was selected to power the FY 1985 buy of F-16C/D aircraft. This year's effort continued the component and engine testing necessary to qualify the engine for production to meet a July 1986 F-16/F110 delivery date. Two blocks of accelerated mission testing provided essentially a full engine life demonstration of the hot engine parts and a half life demonstration of the cold engine parts. Altitude testing at AEDC provided a demonstration that the specification performance and

operability have been met or exceeded by the production configuration engine. Flight testing of a prototype F110 engine in a F-16 test bed began in FY 1984. These tests will establish engine compatibility with the aircraft through special emphasis on augmentor operability and control schedule verification.

(2) (U) FY 1985 Program: Effort will continue in three areas: (1) completion of formal qualification of the F110-GE-100 engine and continued development of associated support equipment; (2) full scale development (FSD) of changes to F-16 C/D aircraft to support the selection of the F110-GE-100 for the FY 1985 buy; and (3) continued development of a configured engine buy for the F-15 that is capable of accepting either the F110-GE-100 or the F100-PW-220 to allow flexibility in future engine buy decisions for F-15 aircraft. The engine development program will include one or more blocks of accelerated mission testing to extend the demonstrated life of the cold engine parts and to qualify value engineering changes to the engine configuration prior to introduction into service in the F-16. The base of component suppliers will be broadened by qualifying parts obtained from alternate production sources during this testing. Reliability status and growth will be verified through the use of Combined Environmental Reliability Testing (CERT) applied to the various electronic components of the engine including the fuel control, and the engine monitoring system processor and computer. The development of changes to the F-16 aircraft to accomodate the F110 will be completed in FY 1985 through a flight test verification of a prototype F110 engine in an F-16 test bed. This flight test will establish the compatibility of the engine with the aircraft and identify tailoring of the engine control schedules needed for the production engine. The F-16 production configuration will be capable of accepting either an F110 or an F100 engine. The design of an F-15 production aircraft configuration that will accept either F110 or F100 engines will continue during this time.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Approximately $2.0 million supports the completion of in-process testing of the F110-GE-100 engine started in FY 1985 and completes the FSD effort prior to starting the Component Improvement Program for this engine. This will conclude the F110-GE-100 development program. The development of a Configured Engine Bay for F-15 aircraft will continue with fabrication of development hardware. The overall development program for F100 and F110 increased performance engines begun under the Engine Model Derivative Program (PE 64218F) will continue with productionizing of the design and procurement/fabrication of FSD test engines. FY 1986 tasks include detailed engine design and hardware procurement. This program is based on a Category IV cost estimate.

(4) (U) Program to Completion: Subsequent FSD funding will provide for each contractor: (1) 600 hours of sea level development test; (2) 450 hours of altitude testing at Arnold Engineering Development Center; and (3) a 4000 total accumulated cycles accelerated mission test. These tests will satisfy the initial service release requirements. The full scale development program for higher performance F100 and F110 engines extends through FY 1989 and is based on a low-moderate risk development schedule. This program will lead to a competitive procurement of either or both engines in the late 1980's for use in F-15 and F-16 aircraft to better meet the improved performance threat at that time.

C. (U) Major Milestones:

Milestones for F110-GE-100	Dates
(1) (U) Production Verification Accelerated Mission Testing	January 1984
(2) (U) Production Verification Altitude Testing	January 1985
(3) (U) Production Verfication Sea Level Testing	October 1984
(4) (U) Integration Flight Test (F-16XL)	January 1985
(5) (U) Production Verification Flight Test (F-16C)	June 1986
(6) (U) First Production Engine Delivery	February 1985
(7) (U) First F-16C/D Delvery with F110 Engine	July 1986

Milestones for F100/F110 Increased Performance Engines	Dates
(1) (U) Contract Go Ahead	February 1985
(2) (U) Preliminary Design Review	September 1985
(3) (U) Critical Design Review	September 1986
(4) (U) Initial Flight Release	March 1987
(5) (U) Production Design Review	December 1987
(6) (U) Full Flight Release	December 1988
(7) (U) Functional/Physical Configuration Audit	July 1989
(8) (U) Initial Service Release	October 1989
(9) (U) First Production Engine Delivery	October 1990

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64231F
DOD Mission Area: #261 - Intertheater Airlift

Title: C-17 Program
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		25,705	123,285	453,681	624,798	2,694,894	4,015,363

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Airlift is required to project and sustain combat forces in a time urgent manner. Specific tasks associated with the airlift mission area include deployment, employment (air-land, airdrop and extraction), sustaining support, retrograde, and combat redeployment. Additional airlift capability is needed for rapid intertheater deployment of combat forces to support national objectives and for timely intra-theater movement to meet forward area mobility requirements. Airlift is vital to meet U.S. mobility requirements and is tailored to respond to contingencies anywhere in the world. The C-17 will be capable of performing the entire spectrum of airlift missions and is specifically designed to effectively and efficiently operate in both the inter-theater and intratheater environments. Because of this unique capability, it will not only increase our overall airlift capability, but will be able to replace the lost capability from retiring C-130 aircraft and C-141s beginning in the late 1990s. Perhaps the greatest benefit is to provide a modern technology aircraft capable of performing the airlift mission in the 21st century at an affordable life cycle cost. The C-17 will meet the airlift needs of the United States and substantially increase our force projection capability, both quantitatively and qualitatively.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	26,565	129,285	364,186		3,333,564	3,947,000

FY 1985 cut of $6 million was a Congressional reduction to meet an expenditure target. Total program increase of $27,327 thousand is due to correction of base year cut caused by incorrect application of inflation adjustment.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Aircraft Procurement:	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Funds	0	0	0	244,900	33,522,800	33,767,700
Quantities	0	0	0	0	210	210

5. (U) RELATED ACTIVITIES: The Air Force is also pursuing near-term programs to provide additional airlift capability. These programs include procurement of 50 C-5B aircraft under PE 41119F, C-5 Airlift Squadrons, 44 KC-10s under PE 27222F, KC-10A, and increasing the Civil Reserve Air Fleet (CRAF) cargo capability under PE 41215F, CRAF Modifications. These acquisitions, in conjunction with C-17, are part of the United States Airlift Master Plan to provide a balanced program for additional airlift that will meet the Congressionally Mandated Mobility Study recommended minimum airlift capability.

6. (U) WORK PERFORMED BY: A program office is established at Aeronautical Systems Division of Air Force Systems Command at Wright-Patterson Air Force Base, Dayton, OH. Douglas Aircraft Company, Long Beach, CA, has been selected as the prime contractor and was awarded a low-level development contract in July 1982. The Air Force Flight Test Center and the Air Force Operational Test and Evaluation Center will conduct developmental and operational flight testing in the full scale development program.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: PE 64213F, C-17 Program

A. (U) Project Description: This program element provides for development of the C-17, an aircraft capable of carrying outsized cargo over intercontinental distances into austere airfields. The C-17 is a major initiative to improve our rapid deployment capability, provide the lift capability to move heavy mechanized Army/Marine Corps equipment in-theater and replace the capability lost from retiring C-130 and C-141 aircraft beginning in the late 1990s.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: McDonnell-Douglas has completed the low level development effort. The final phase of major wind tunnel testing was completed to develop basic aerodynamic data, validate cruise performance estimates, determine aircraft stability and control characteristics, and aerodynamic loads data bases for full scale development. The full size cargo compartment and flight deck mockups were updated to reflect current configurations and functions of major crew station systems. Construction is underway on a 20-foot full scale mockup of the lower fuselage and floor section with operational cargo loading systems. The engine fan and core scale model thrust reverser testing has been completed. Design analyses and studies to evaluate alternative avionics architectures and flight control/avionics interface were completed. A study was completed which examines the concurrent development of an EC-17 airframe that could replace the present EC-135 aircraft in the 1990s. The system for accumulating a common reliability and maintainability (R&M) data base was refined, and initial estimates and subsystem allocations were updated in anticipation of formal R&M/design tracking. A comprehensive Logistics Support Analysis Support System was developed, tested and validated. Work is ongoing to develop the repair level analysis interface. The C-17 contract is being restructured to reflect initiation of full scale development in FY 1985.

(2) (U) FY 1985 Program: Begin full-scale development. Low-speed wind tunnel model testing and flutter model testing will continue. Analysis of aerodynamic data acquired during earlier wind tunnel testing will continue for refinement and update of the performance, aerodynamic loads, and stability and control data bases. The 20-foot full scale cargo loading system will be completed and further design analyses done with it and the full scale cargo compartment mockup. Full scale reverser testing with a Pratt and Whitney 2037 engine will be initiated and completed. Structural analyses and definition of structural layouts will continue based on the completed wind tunnel tests and analyses of results. Design analyses and layout of subsystems, drawing preparation for long lead items and equipment specification updates will be accomplished. All major mockups will be completed and structural development tests will be continued. Functional subsystem mockup design and development will be initiated. Drawing releases will begin. Tool design and manufacturing planning will be initiated. Preliminary design reviews will be initiated. Formal logistics support analyses and design-to-life cycle cost systems will be implemented.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full scale development will continue. Structural development testing will continue in support of the structural design activity. Activities will focus on the detailed definitions of the C-17 structural and subsystem configurations. Laboratory, ground and wind tunnel tests will continue. Work will commence on an avionics development and integration facility. Organizational and intermediate support equipment hardware preliminary design review and support equipment system requirements review will be conducted. Initial support equipment development testing will begin. Logistics support analyses and design-to-life cycle system analyses will continue. Reliability and maintainability design tracking and analysis will continue. Current program cost estimates are mature.

(4) (U) Program to Completion: Funds will be used for completion of production design effort, assembly and test of durability/static test articles, completion of design specifications on procurement items and software, and completion of support equipment design. Funds will also be used for completion of subsystem and component development, flight simulator testing, tooling and parts fabrication. Manufacturing assembly, flight test and systems evaluation will be completed on the full scale development flight test articles.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Contract Award	July 1982
(2)	(U)	Initiate Full Scale Development/Defense Systems Acquisition Review Council II	2Q FY 1985
(3)	(U)	Complete Preliminary Design Reviews	1Q FY 1986
(4)	(U)	Complete Critical Design Review	1Q FY 1988
(5)	(U)	Begin Fabrication	1Q FY 1988
(6)	(U)	First Flight	1Q FY 1990
(7)	(U)	1 Life Cycle Complete on Durability Article	1Q FY 1991
(8)	(U)	Development Test and Evaluation/Initial Operational Test and Evaluation Complete	3Q FY 1991
(9)	(U)	Initial Operational Capability	2Q FY 1992

Budget Activity: 4, Tactical Programs
Program Element: 64231F, C-17 Program

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): Preliminary wind tunnel testing has been conducted during the low-level development phase of the program. Major test phases will be development ground testing, combined Development Test and Evaluation (DT&E)/Initial Operational Test and Evaluation (IOT&E), dedicated IOT&E, post Defense Systems Acquisition Review Council DT&E, and production acceptance test and evaluation. DT&E will be conducted to assist engineering design and development, verify accomplishment of specification requirements, characterize system performance, and insure critical issues have been sufficiently resolved to permit a production decision at Milestone III. DT&E/IOT&E will be conducted using one full-scale development aircraft and four production aircraft. These aircraft will be tested at government test sites except for the first flight. Initial airworthiness testing will be conducted at Edwards AFB, CA, under a combined test force with the Air Force Flight Test Center taking the lead in DT&E. Development tests include stability, control, and performance as well as reliability, maintainability, and availability.

2. (U) Operational Test and Evaluation (OT&E): Initial testing will be accomplished under a combined DT&E/IOT&E concept. Air Force Operational Test and Evaluation Center (AFOTEC) will take the lead in operational testing which will be conducted by a combined test team with AFOTEC, Air Force Flight Test Center, US Army, and US Marine Corps participation. Testing will be conducted under day/night adverse weather conditions and will consist of evaluations in the following areas: ground operations at both a main operating base and a small, austere airfield to include quick reaction capability, quick turnaround time, and ground handling characteristics and procedures; inter/intra-theater airland/airdrop missions, air refueling, aeromedical evacuation, formation, and low-level operations; crew/system interface; compatibility/interoperability with elements of the Air Force airlift system and with other government agencies and forces of the Army and NATO; training requirements and concepts; operational assumptions used to project service life; survivability; software effectiveness, usability, and maintainability; system reliability and maintainability, logistics supportability, and operating and support cost elements of the life cycle cost model. In addition, a minimum of five aircraft months of dedicated IOT&E will be conducted to assess unique IOT&E objectives. These tests will be conducted in a realistic operational environment (i.e., deployment for a minimum of one to two months to an operational Military Airlift Command (MAC) base where composite operational missions will be flown into and from MAC and Army bases). Testing will be conducted using Air Force "hands-on" maintenance to the maximum extent feasible.

Budget Activity: 4, Tactical Programs
Program Element: 64231F, C-17 Program

3. (U) Systems Characteristics: All system performance, reliability, maintainability, and availability characteristics are specified in the contract with McDonnell Douglas Corporation. Demonstrated characteristics will not be valid until FY 1992.

Characteristic	Objective/Threshold	Demonstrated
Aircraft Dimensions (Height, Length, Wing Span)	55.1' x 175.2' x 165.0'	
Cargo Compartment Dimensions (Height, Width, Length)	12.3' x 18.0' x 87.0'	
Max Allowable Cabin Load (ACL)	172,200 lb	
Range @ max ACL	2,400 NM	
Takeoff Ground Roll	6,510 ft	
Landing Ground Roll	1,550 ft	
Speed (Knots True Airspeed - KTAS)	450 KTAS	
Ground Maneuvering (180 degree turn)	80 ft	
Reliability (system mission completion success probability)	0.93%	
Maintainability (air vehicle maintenance man-hours per flight hour)	18.6	
Availability (full mission-capable rate)	74.7%	
(partial mission-capable rate)	82.5%	

4. (U) Current Test and Evaluation (T&E): DT&E/IOT&E is not currently planned until FY 1990.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64236F
DOD Mission Area: #221 - Counter Air

Title: Infrared Search and Track System (IRSTS)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		N/A	N/A	23,657	35,377	85,837	144,871

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a joint full scale development and pilot production (40 units) by two competing contractors of an infrared search and track system (IRSTS) for the Navy F-14D and USAF F-15. The IRSTS is applicable to the USAF F-16 and Advanced Tactical Fighter (ATF).

Supporting requirement documents include Air Defense Tactical Air Command (ADTAC) Statement of Need (SON) 10-70 (revalidated July 1983), Draft Tactical Air Force (TAF) SON 304-83, Advanced Tactical Fighter/Air-to-Air, and Draft Tactical Air Force (TAF) SON 308-84 for Fighter/Interceptor IRSTS.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. RELATED ACTIVITIES: This is a Joint Air Force/Navy program for the F-15 and F-14D. A Memorandum of Agreement (MOA) was signed on 24 May 84, designating the Air Force as executive service and directing continued development of the current Air Force program. This MOA calls for Navy participation in the FY 1984/1985 Advanced Development flight tests, rapid transition to Full Scale Development (FSD), joint F-15/F-14D flight tests, and delivery of 25 units to the Navy by to meet the F-14D schedule. Each service agreed to pay 100% of airframe unique costs, while the Air Force pays 60% and the Navy pays 40% of common IRSTS costs. Weekly coordination meetings have already begun between the Air Force and Navy. This is a transition of the IRSTS technology being developed by the Air Force Wright Aeronautical Laboratories (AFWAL) in PE 63203F, Project 69DF, IRSTS. Advanced Demonstration Model flight test by two contractors will be completed in FY 1985.

Program Element: #64236F
DOD Mission Area: #221 - Counter Air

Title: Infrared Search and Track System (IRSTS)
Budget Activity: #4 - Tactical Programs

6. (U) WORK PERFORMED BY: General Electric Company, Aircraft Equipment Division, Utica NY, and ITT Corp Avionics Division, Nutley, NJ are the prime IRSTS competitors. Northrop Electro-Mechanical Division, Anaheim, CA, is a major subcontractor to ITT Corp. McDonnell Aircraft Company, St. Louis, MO, will be the prime contractor for F-15 integration while Grumman Aircraft Company, Long Island, NY, will be the prime contractor (with USN) for F-14D integration. Air Force Systems Command, Aeronautical Systems Division is the Air Force Agency in charge of this program.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64236F, Infrared Search and and Track System (IRSTS)

A. (U) Project Description: This is a joint full scale development for the USAF F-15 and the Navy F-14D. The IRSTS is also applicable to the USAF F-16 and Advanced Tactical Fighter (ATF). See paragraph 2 above for additional information.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable.

(2) (U) FY 1985 Program: Not Applicable.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Based on results of the Advanced Development comparative flight demonstrations conducted in FY 1985 (under PE 63203F) Full Scale Development (FSD) contracts will be awarded to competing contractors which will finalize design definitions.

(4) Program to Completion: IRSTS design definition and equipment development will be completed.

Program Element: #64236F
DOD Mission Area: #221 - Counter Air

Title: Infrared Search and Track System (IRSTS)
Budget Activity: #4 - Tactical Programs

C. (U) Major Milestones:

Milestones	Dates
(1) Advanced Development Flight Test Completion	
(2) Interface Control Document Complete	
(3) Critical Design Review	
(4) Engineering Demonstration Model Delivery	
(5) First Flights	
(6) Start Pilot Production Deliveries to the Navy	
(7) Initial Air Force Production Delivery	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64247F
DOD Mission Area: #225 - Air Warfare Support

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	15,765	11,851	9,962	33,556	Continuing	Not Applicable
3161	MATE Continuing Development	15,765	9,000	6,000	13,495	Continuing	Not Applicable
3162	MATE Operations Center	0	2,851	3,962	20,061	Continuing	Not Applicable

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Previous and current methods used to specify, design, build and support automatic test systems have resulted in a proliferation of equipment, low operational reliability and supportability, and increased life cycle costs. A major reason why aircraft availability (force readiness) is below desired levels is because of malfunctioning automatic test equipment at all organizational levels. The Modular Automatic Test Equipment (MATE) program has developed a set of guides which delineate a standard architecture and a management system for automatic test system (ATS) acquisition and support that establish a framework for the acquisition and support of future Air Force automatic test systems. In addition, a government owned MATE Operations Center will be developed to manage the MATE developed software, as well as perform verification testing on proposed MATE modules. Cost estimates are based on program office experience and priced contractor agreements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY:

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	16,034	15,798	13,387		Continuing	Not Applicable

- The FY 1985 change reflects a $3.947 million Congressional action.

- The FY 1986 change reflects a $2.0 million reduction due to higher priority requirements, a $1.0 million reduction due to revised program requirements, and a $0.425 million reduction due to revised inflation estimates.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The Navy assigned a full-time representative to the MATE Program Office in early 1979 to make sure MATE stays attuned to their needs. The Navy developed built-in test design guides and the fault isolation/fault detection work being done at the Air Force Rome Air Development Center will provide a basis for decisions concerning the partitioning of test functions between the ATS and built-in test equipment. The Navy has developed, in conjunction with the Army and Air Force, the military standard on testability used in the MATE program, "Testability Program for

Electronic Systems and Equipment". Program Element (PE) 27131F, A-10 Squadrons provided funds for procurement of up to 26 A-10 inertial navigation system (INS) automatic test equipment stations. Other related program elements include: PE 62204F, Aerospace Avionics, Project No. 2003, Avionics System Design Technology, and Project No. 6069, Electronic Device and Circuit Technology; PE 63253F, Advanced System Integration Demonstration (PAVE PILLAR); PE 64219F, Integrated Digital Avionics; PE 64201F, Project No. 2560, JOVIAL Language Control Facility, and Project No. 2297, Software and Computer Standardization. To prevent duplication, all cognizant Army, Navy and Air Force organizations are supplying inputs to reviews of the MATE program and guides. The MATE Program Office supports the Joint Logistics Commanders (JLC) Panel on Automatic Testing as funds and personnel permit. The Army and Navy continuously evaluate MATE products for inclusion in their ATE efforts via the JLC Panel. An industry MATE Users Group (MUG) was formed as a subgroup of the Automatic Testing Committee of the National Security Industrial Association (NSIA) to provide a wide forum and feedback for MATE progress and policy.

6. (U) WORK PERFORMED BY: This program is being implemented by the Support Equipment Systems Program Office of the Aeronautical Systems Division at Wright-Patterson AFB, OH. Supporting laboratories are the Air Force Avionics Laboratory, located at Wright-Patterson AFB, OH, and the Rome Air Development Center at Griffiss AFB, NY. The system definition contractors were the Sperry Corporation, Great Neck, Long Island, NY (winner of the full-scale development contract); The Westinghouse Electric Company, Hunt Valley, MD; Technology Development Corporation, Arlington, TX; and the Emerson Electric Company, St. Louis, MO. The MATE Operations Center is managed by the Directorate of Material Management of the San Antonio Air Logistics Center at Kelly AFB, TX.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Starting in FY 1985, the MATE Program Element effort has been divided into two projects to allow for better tracking of the follow-on continuing development for MATE and actual implementation of the MATE baseline after the initial phase of full-scale development (FSD) is complete.

A. (U) Project: 3161, MATE Continuing Development: Implementation and use of the MATE system, as defined in the MATE Guides, will result in automatic test systems which meet Air Force readiness requirements and will provide for standardized interfaces. This will assure adequate support for our forces in a more cost effective manner and at the same time, simplify the support of automatic test systems and control proliferation of hardware and software at both the module and weapon system levels. The first applications of the MATE system have been the Intermediate Automatic Test System (IATS) for the A-10 Inertial Navigation System (INS) and the Depot Automatic Test System for Avionics (DATSA); these were developed using non-MATE funds. The acquisition of these automatic test systems was supported as part of the MATE full-scale development program. While the framework (manuals, specifications, and guides) and tools for future ATE have been developed as a baseline for today, continued development and enhancement of the MATE architecture is necessary to include other areas of ATE (e.g., "suitcase" testers) and prevent technical obsolescence. During FY 1984 this project: continued full-scale development of the MATE system and established a MATE baseline for use by all new Air Force acquisition and/or modification programs; published the Air Force Systems Command/Air Force Logistics Command regulation implementing MATE institutionalization; continued deliveries and operational testing of the A-10 INS IATS (deliveries and testing, due to complete in FY 1984, were intentionally delayed by six months to provide additional capability to the IATS); continued replacement of the General Purpose Automatic Test System (GPATS) with the DATSA to support continuing depot-level workloads on C-141, F-111, F-4, F-105 and F-106 aircraft; and initiated

planning for development and implementation of an organic Air Force capability to verify MATE hardware and software for application to future Air Force automatic test systems. In FY 1985, this project will continue implementation of MATE by actively assisting programs to insure that the standards and architecture are correctly applied; complete deliveries and operational testing of the A-10 Inertial Navigation System (INS) Intermediate Automatic Test System (IATS); continue technical support for the acquisition and installation of the Depot Automatic Test System for Avionics (DATSA); and plan for and initiate updates to the MATE system to enhance the MATE architecture for multi-system applications, for guide updates, and for application to non-avionics systems. In FY 1986, this project will keep MATE abreast of the test requirements generated by new Unit Under Test (UUT) technology by incorporating new technologies such as Very High Speed Integrated Circuits (VHSIC), Ada, and fiber optics into MATE, and developing standards for flight-line mobile "suitcase" testers. This project will also maintain and update an institution framework for the Air Force to continue development and application of the MATE concept.

B. (U) Project: 3162, MATE Operations Center: The MATE system has a continuing need for an organic capability to develop and support MATE software, perform MATE module verification testing, train all levels of acquisition managers in MATE acquisition and support procedures, and insert new technologies into automatic test systems. This project will provide the Air Force with positive/absolute control of the MATE system architecture and enhances corporate memory, program viability, and continuity by developing an organic Air Force MATE Operations Center. These efforts are currently being conducted by a contractor. This situation is stifling industry involvement, thereby reducing the high potential payoff. This project did not exist in FY 1984. However, the efforts are split from the ongoing Project 3161 to allow for better tracking between continuing development and implementation and application of the existing MATE baseline. In FY 1985 and 1986, this project will provide for necessary actions for MATE baseline implementation, such as: (1) initiate development of the organic Air Force capability to verify MATE hardware and software for future ATS development and replacement programs; (2) continuing essential support of standardization of MATE products; (3) analyses of newly developed modules to stay abreast of new technology; (4) continued improvement of UUT test software through application of artificial intelligence; and (5) delivery of a single MATE verification station to the San Antonio Air Logistics Center.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64249F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Night/Precision Attack
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		58,092	98,338	40,849	44,657	64,564	576,100*
2693	Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN)	58,092	98,338	40,849	44,657	64,564	576,100*

*Includes $86.7 million which was funded under program element 63249F, Night Attack, prior to FY 1983, but does not include any target recognizer or simulator funds.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The LANTIRN program includes development and testing of a wide angle raster Head-Up Display (HUD), a navigation pod, and a targeting pod. The navigation pod contains a terrain following radar and fixed forward looking infrared (FLIR) sensor; the targeting pod contains a gimballed FLIR, a laser designator, an automatic tracker, a missile boresight correlator, and growth provisions for an automatic target recognizer. The need for LANTIRN is documented in Tactical Air Forces' Statement of Operational Need 302-81, Night Attack Capabilities. The LANTIRN program responds to that need by providing the capability to conduct close air support and interdiction missions at night and under the weather for F-15E, F-16, and A-10. The threat by the enemy's formidable armored and air forces, especially that of the Warsaw Pact against the North Atlantic Treaty Organization (NATO), has increased in the past few years and is projected to become stronger in both quantitative and qualitative terms. Enemy armor, equipped with night vision capability and accurate laser ranging systems, has been combined with new hardware, training and operational doctrine to assure a continued enemy thrust during night and adverse weather conditions. Successful interdiction and close air support missions against this projected threat require accurate target acquisition and weapons delivery against small mobile targets as well as fixed targets. LANTIRN provides the capability not only to attack at night, but also to attack with precision laser guided weapons day or night.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	58,092	98,338	43,615	N/A	80,700	549,900
Procurement	0	190,300	441,900	N/A	2,665,900	3,304,100
Pod Sets (Nav & Tgt)		4	35	N/A	681	720

Explanation: Congress appropriated $90 million for navigation pod production only in FY 1985, based on performance problems encountered with the LANTIRN targeting pod at Edwards AFB CA in 1984 during development testing. Because the targeting pod did not progress as fast as the navigation pod in development testing, the Sec AF directed a restructure of the LANTIRN production program in August 1984. Negotiations for the restructured LANTIRN program were completed with Martin Marietta Corp. in early February 1985. The negotiated agreement covers 700 pod sets and associated support equipment within the AF LANTIRN funding cap of $2.31 billion (base year 1980 dollars). The envisioned firm fixed price contract covers FY 1985-91 LANTIRN production requirements for the F-15E, F-16 and A-10 aircraft. An RDT&E cost increase of $26 million to fully fund the A-10 LANTIRN integration has been added in the "Additional to Completion" column. A Procurement cost increase of $194 million has also been added to the "Additional to Completion" column to fully fund LANTIRN pod set production. Both of these cost increases are within the AF LANTIRN funding cap.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Pod Procurement (Aircraft)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Funds (PE 27249F)	0	90,000	436,400	786,100	2,180,000	3,498,500
Quantities:						
Navigation Pod	0	2+4LL[1]	7+2LRU[1]	143	548	700
Targeting Pod	0	0	2+4LL[1]	7+2LRU[1]	691	700

[1] Long Lead (LL) parts; Line Replaceable Units (LRU)

5. (U) RELATED ACTIVITIES: The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) workload evaluations were accomplished using an A-10 testbed aircraft at Edwards AFB, CA. This effort was managed by the A-10 program office at Wright-Patterson AFB, OH, and is closely monitored by the LANTIRN program office. The Avionics Laboratory is also managing an Advanced Fighter Technology Integration program (PE 63425F), employing the F-16 with a Forward Looking Infrared (FLIR) mounted internally in the left strakelet position. Automatic target recognizer technology, which was transferred to advanced development under Night Attack Program (PE 63249F) in FY 1983, will be evaluated in FY 1985 to determine whether the technology is sufficiently mature for full scale development. Integration of the LANTIRN into the host aircraft will be accomplished by the aircraft manufacturer under the appropriate aircraft program element.

6. (U) WORK PERFORMED BY: The LANTIRN program office, Aeronautical Systems Division, is located at Wright-Patterson Air Force Base, OH. The LANTIRN prime contractor is Martin Marietta, Orlando, FL. Major subcontractors include Texas Instruments, Dallas, TX for terrain following radar; Hughes Aircraft Corporation of Canoga Park, CA for missile boresight correlator; Delco Electronics, Milwaukee, WI for Military Standard 1750 computers; Sperry Systems Management of Great Neck, NY for pod automatic test support equipment; and Grumman Aerospace Corp. of Long Island, NY for portions of optics support equipment. The heads-up-display prime contractor is Marconi Avionics, Rochester, England.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2693, LANTIRN

A. (U) Project Description: LANTIRN will provide a capability for low altitude precision attack during night and in conditions of limited visibility for air-to-surface interdiction and close air support missions. LANTIRN consists of a navigation pod, a targeting pod, and associated integration with aircraft heads-up and heads-down displays. The program total cost has been capped at $2.31 billion (in 1980 dollars).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Six navigation pods and six targeting pods were available for flight test, integration, and reliability test. Development flight testing ceased in September to prepare for navigation pod Initial Operational Test and Evaluation (IOT&E) at Loring AFB, ME. Targeting pods were returned to Martin Marietta Corporation (MMC) in early September for modification in preparation for further developmental flight testing. Support Equipment completion slipped six months and A-10 integration slipped two years because of FY 1984 RDT&E funding reductions. The LANTIRN program was restructured in August 1984 because of deficiencies identified in the targeting pod tests. The Air Force now plans to make a production decision on only the navigation pod in FY 1985 and restart the Development Test and Evaluation (DT&E) on the targeting pod in December 1984; the Initial Operational Test and Evaluation (IOT&E) of the targeting pod is scheduled for September 1985 with a production decision in February 1986. The navigation pod accumulated over 15,000 miles at night, under 500 feet, at speeds greater than 450 knots.

(2) (U) FY 1985 Program: Initial operational test and evaluation of the navigation pods on F-16 aircraft was conducted out of Loring AFB, ME for flights over representative European terrain at a Canadian test range from October through December. The IOT&E was completed in late December 1984. The test results were very encouraging. Targeting pod development test and evaluation will continue at Edwards AFB, CA. Support Equipment will continue in development, design, and initial fabrication. Production go-ahead for the navigation pod is planned for February 1985, after completion of all development and initial operational test and evaluation. The production decision and succeeding program activity will depend n a favorable decision by the Sec AF in February 1985. Contract negotiations with Martin Marietta were completed for the restructured LANTIRN production program in February 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Initial operational test and evaluation of the targeting pod is scheduled for completion by December 1985. Production start for the targeting pod is contemplated for early second quarter FY 1986. LANTIRN system integration on the F-15E aircraft will also begin, and LANTIRN support equipment development will continue.

(4) (U) Program to Completion: The F-15E flight test starts in FY 1987 and runs through FY 1988. Also the A-10 LANTIRN integration and flight test is due to start in FY 1988 with a flight test commencing in FY 1989. Production of navigation and targeting pods will continue with up to 720 pod sets being procured and produced through FY 1993. Deliveries of the navigation pod are tentatively scheduled to start in FY 1987. Targeting pod deliveries are scheduled to start in early 1988. These pods will be delivered to F-15E, F-16 and A-10 aircraft operational units.

C. (U) Major Milestones:

Milestones		Dates
(1) (U) Basic Contract Award		September 1980
(2) (U) Critical Design Review (Pods & Heads Up Display)		June 1982
(3) (U) Start Navigation Pod Development, Test and Evaluation		July 1983
(4) (U) Begin Target Pod Development, Test and Evaluation		October 1983
(5) (U) Navigation Pod Initial Operational Test and Evaluation Completed		November 1984
(6) (U) Production Decision for Navigation Pods (AFSARC III)		February 1985
(7) (U) F-16 "Heads Up" Display Production Decision		May 1985
(8) (U) Target Pod Initial Operational Test and Evaluation		September - December 1985
(9) (U) Targeting Pod Production Decision (AFSARC III)	*February 1985	February 1986
(10) (U) First Navigation Production Pod Delivery	*(TBD)	April 1987
(11) (U) First Targeting Pod Production Delivery	*(TBD)	April 1988

* Dates shown in FY 1985 Descriptive Summary

Explanation of Milestone Changes:

(9) (U) Targeting pod production has slipped approximately one year to correct performance and reliability deficiencies identified in Development test, in FY 1984

(10 & 11) (U) Negotiated with Martin Marietta Corp in February 1985

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64268F
DOD Mission Area: #225 - Air Warfare Support

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		125,280	148,115	138,574	133,994	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Aircraft engine component improvement programs (CIP) are initiated after an engine/component has successfully completed all of the required development tests, meets the specification in the development contract, and the first production funded aircraft using the engine/component is accepted by the Air Force. Historically, systems add offensive/defensive equipment, have mission and/or tactics changes and operate in different environments to meet the ever-changing threats. It has been demonstrated that an active engine component improvement program is an effective means of reducing the cost of engine ownership, and improving system operational readiness through improvements in durability, maintainability, operability, reliability, repairability and suitability of the engine as operational conditions change and service time is accumulated. System changes continue throughout the operational life of a system. Therefore, the engine CIP must continue at a reasonable level to provide the engineering support required to obtain engine changes which are essential for satisfactory system performance at a cost affordable to the Air Force. The funds being requested represent Air Force requirements only and do not include funds required from other Services or Foreign Military Sales.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	125,230	149,785	166,551		Continuing	N/A

(U) FY 1986 funding was reduced to support higher priority programs.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: For requisite technology, this program draws on "core" engine technology (compressor, combustor, and high pressure turbine) from Program Element (PE) 63216F, Advanced Turbine Engine Gas Generator. Fan and low pressure turbine technology are provided by PE 63202F, Aircraft Propulsion Subsystem Integration. Materials processing and component fabrication demonstration come from PE 78011F, Industrial Prepardness Program. Additional component/engine test data is contributed by PE 64218F, Engine Model Derivative Program. The Navy and Army have supporting engine component improvement programs, PE 64268N and PE 64268A. PE 64209F, F100 Durability, is developing the Digital Electronic Engine Control and gear type main fuel pump. This development together with the Increased

Life Core provided by the Component Improvement Program form the basis for the 4000 Total Accumulated Cycles F100-PW-220 engine.

6. (U) WORK PERFORMED BY: The overall program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. Individual engine component improvement programs are managed by the Aeronautical Systems Division, Deputy for Propulsion and the Air Force Logistics Command's San Antonio Air Logistics Center and Oklahoma City Air Logistics Center. In-house test and evaluation efforts are conducted at the Arnold Engineering Development Center, Tullahoma, TN, and the Air Force Flight Test Center, Edwards AFB, CA. Contractors include Allison Gas Turbine, Division of General Motors, Indianapolis, IN, (T56, TF41 engines); General Electric Company, Evendale, OH, (J79, TF39, F101, F110 engines) General Electric Company, Lynn, MA, (J85, J85-21, TF34, T64, T58, T700 engines); Air Research (Garrett), Phoenix, AZ, (T76, F109 and Ground Turbine Engine); Pratt and Whitney Aircraft of Canada, Ltd (T400); Pratt and Whitney Aircraft, West Palm Beach, FL, (J57, J75, F100, TF30, TF33 engines); Solar Turbine Inc., San Diego, CA, (GTE); and Teledyne CAE, Toledo, OH, (J69 engine).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64268F, Aircraft Engine Component Improvement Program (CIP)

A. (U) Project Description: A CIP is required for each operational engine in order to be able to identify and resolve potential cost avoidance and operational problems that arise during service use. The CIP for each engine generally consists of the following types of efforts: (1) analytical and test efforts to identify the life limiting parts of an engine so that corrective actions can be initiated before operational use is impacted; (2) evaluation of new hardware for reducing adverse engine impact on the environment; (3) demonstrations to provide review/revision of maintainability actions to establish and update inspection limits and techniques for field and overhaul activities; (4) investigation of field and test failures to determine the significance and, where appropriate, generate changes on a timely basis to reduce the impact on the aircraft mission; (5) reduction of maintenance and spare parts costs through the development, evaluation, qualification, and introduction of repair techniques or redesigned parts; and (6) flight and ground tests on engines/components to provide immediate investigation of service revealed discrepancies and to evaluate proposed engineering changes. Age, use, quantity of engines and operational experience are factors considered in determining the resource allocation to each of these efforts within a given engine CIP.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The engine Component Improvement Program continued to develop engineering changes to correct safety of flight problems, resolve flight revealed deficiencies and make major contributions for improved readiness by reducing/eliminating causes for unscheduled engine removals and attacking the major

contributors to high maintenance manhours per engine flying hour. Estimated life cycle cost avoidance accomplished this year through the Component Improvement Program was $1,237 million.

For the F100 engine used in the F-15 and F-16 aircraft, the Component Improvement Program consisted of reducing the incidence of engine stall-stagnations thus enhancing operational utility. Readiness improvements from increased reliability for the unified fuel control, back up control, high pressure turbine hardware and augmentor/nozzle hardware resulted from CIP accomplishments. These CIP developed design improvements provided improved overall system availability and reduced support costs. Substantiation of an improved inlet anti-ice capability was completed, along with an improved Low Cycle Fatigue (LCF) life 2/3 spacer and an improved divergent seal. A 4000 Total Accumlated Cycles (TAC) Accelerated Mission Test was completed on the improved life core configuration. For the F101 engine for the B-1B aircraft, major emphasis was placed on engine performance retention, improved life capability for the high pressure turbine disk, forward outer seal, high pressure turbine blade and low pressure turbine stage 1st blade. These improvements provide increased life which offers improved readiness at reduced life cycle cost.

The TF34 engine Component Improvement Program completed the damage tolerance assessment inspection interval development for improved flight safety. Crack growth assessment testing was completed for life extension of critical life limited parts. Engine performance deterioration was reduced through improved leakage and clearance control. CIP on the TF30 engine continued the life extension effort for P100 model life limited parts. These included float wall louvers for longer combustor life, correction of a compressor stator cracking problem and improved compressor disk LCF life. The TF41 CIP reduced high oil consumption/high oil leakage problems and engine manifold fuel leaks, resulting in improved flight safety and improved readiness by reducing unscheduled engine removals. Flight safety for the J79 was also improved by correcting fuel leaks through an improved base/swivel flange and an improved afterburner pump seal. All other Air Force operational engines were supported with improved flight safety, readiness and reduced cost of ownership initiatives through CIP.

(2) (U) FY 1985 Program: This program provides continuing engineering support for all engines in the Air Force operational inventory. For all engines, this program contains a series of specific tasks to reduce/eliminate Class A and Class B mishaps, reduce air aborts, reduce premature engine removals per 1000 engine flight hours, reduce maintenance manhours per engine flight hour and reduce the cost of operating and supporting the engine.

(U) F100: Final verification of improved hot section durability from the increased life core will be completed. Improved functional operation will result from reducing augmentor blowout and engine stall.

(U) F101: Performance retention improvements will be demonstrated. Repair procedures for parts that are life limited will be developed/demonstrated to prevent overhaul line stoppage. Overall engine life management program will be continued with test verification of improved engine hot section durability and cold part durability being demonstrated on production tooled engine hardware.

Program Element #64268F
DOD Mission Area: #225 - Air Warfare Support

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: #4 - Tactical Programs

(U) TF34: This program is structured to provide a cost effective engineering program to design, qualify and introduce hardware changes to address the following goals: (1) reduce unscheduled engine removals per 1000 engine flight hours by 15 percent; (2) reduce maintenance manhours per engine flight hour by 20 percent. Effort will also be directed toward eliminating all failure modes which impact safety of flight and toward improving operational readiness. The program continues a life management program which provides a means for predicting and tracking hardware low cycle fatigue and thermal cycle life limits; development and evaluation of component repair procedures to reduce the frequency of repair replacement of major components. Extensive factory accelerated mission testing and component testing will be accomplished.

(U) TF30: The contractual engineering effort for this engine will cover the continued redesign/modification necessary to resolve flight safety failures, to evaluate and correct service revealed deficiencies, and to provide engineering designs for developing and testing repairs for depot and field implementation. Efforts will include work on improved life for compressor rotor parts, improved life high pressure turbine rotor and a more durable fourth stage turbine blade. Design improvements are intended to reduce air aborts per 1000 engine flight hours by 20 percent, reduce unscheduled engine removals by ten percent, and reduce maintenance manhours per engine flight hour by eight percent.

(U) TF41: Efforts will be conducted to resolve flight safety problems, address service revealed deficiencies and assist logistics support by developing repair procedures. Effort will be expended for a life limit extension. Extensive accelerated mission testing will be accomplished. These and other planned tasks should: (1) reduce air aborts per 1000 engine flight hours by 20 percent, (2) reduce unscheduled engine removals by 20 percent, and (3) reduce maintenance manhours per engine flight hour by ten percent.

(U) TF39: Engineering effort will be directed towards resolving service revealed problems and conducting fleet leader engine testing to provide early problem identification and correction as well as verifying fixes for service revealed deficiencies. Major effort will be directed toward the development of repair procedures to extend the useful life of expensive parts such as compressor case cracking and fan interlock wear. Support will be provided for the new -1C model. Testing will include a 1000 cycle endurance test and some service evaluation flight testing.

(U) T56: The program will continue to address: (1) safety of flight problems, (2) improvements to maintain operational utility, (3) reduce field maintenance manhours and costs, (4) reduce overhaul and spare parts costs, (5) reduce premature engine removals, and (6) develop repair procedures to extend useful life of high value parts. Efforts planned include continued work to improve fatigue life limited turbine blades, evaluate an erosion resistent coating to improve compressor performance deterioration characteristics and develop increased load capacity front pinion bearings. Testing includes accelerated endurance, simulated flight endurance, and component rig evaluation tests.

(U) Other Engines: The programs for the other engines are directed toward the resolution of service revealed problems with primary emphasis on correction of all safety of flight problems. Development of repair procedures or workarounds to prevent overhaul line stoppage and maintain logistic support for the engines will be accomplished. Testing will be accomplished to verify fixes and repair procedures.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The Engine Component Improvement Program (CIP) is a continuous program carried on throughout the service life of the engines. Engineering effort will include the following general areas in conducting a CIP for engine and related hardware.

(a) (U) Investigation, definition and correction of service revealed deficiencies.
(b) (U) Improve engine reliability and maintainability by improving on the design of marginal components.
(c) (U) Extend the maximum opperating time of the engines.
(d) (U) Reduce overhaul cost by qualifying new wear limits and determining parts life.
(e) (U) Maintain engine specification requirements.
(f) (U) Provide a review of maintainability actions, establish and update inspection limits and techniques for field and overhaul activities.
(g) (U) Provide early disclosure of any weakness that would limit engine life and would normally appear only after extended service operation.
(h) (U) Reduce maintenance and spare parts cost through the review, evaluation and introduction of repair techniques.
(i) (U) Initiate action to redesign and improve the marginal parts/components as soon as investigation and identification of potential weaknesses indicates such action is appropriate.
(j) (U) Reduce/eliminate causes of engine performance deterioration.

(U) The general activity above applies to all engines in the Air Force inventory to one degree or another. FY 1986 is critical because three high technology engines will be entering the inventory and engineering support during the initial introduction is essential to prevent long term problems impacting mission capability and aircraft availability.

The major FY 1986 efforts will be as follows:

(U) F100: Investigate and develop repair procedures to extend the useful life of high value parts; conduct extensive testing to verify repairs/redesigns and to discover potential problems ahead of fleet experience; reduce production engine removal rate from 5.2 to 4.8 per 1000 engine flight hours resulting in $50M per year cost avoidance associated with maintenance actions; reduce maintenance manhours per engine flight hour from 2.0 to 1.8; develop improved anti-icing capability for the fan; extend maximum operating time for the backup control; develop increased durability and reduced maintenance for the augmentor/nozzle and develop/test improved durability core engine components and respond to causes of unscheduled engine removals.

(U) TF34: Effort on this engine will be directed toward identifying and resolving engine problems/weaknesses before they occur in the field. This will be accomplished through extensive testing and analysis. Tasks include continuation of life management and damage tolerance assessment programs and resolution of the problem of corrosion due to water collection. These efforts will indentify problems early, improve support requirement estimates, and prevent non-availability of engines due to lack of spare parts.

(U) F101: Continue fleet leader engine testing (accelerated mission test). Demonstrate engine cold part life to

9000 hours of simulated use. Demonstrate production configuration to 3000 flight hours. Update Engine Structural Improvement Program analysis for parts life management to determine required inspection intervals.

(U) TF30: Testing will be conducted to verify fixes resulting from the fatigue life improvement program to continue extending the time on lead-the-fleet test engines. This engine has four models that have widely different mission usages which require additional testing to evaluate improvement against these mission differences. Several impending safety of flight problems will be addressed. Tasks include continuation of fan containment capability development and life extension for fan discs. Repair procedures will be developed to salvage high value components by extending their useful life. These efforts are essential to resolve problems, to support the F-111 fleet, and to prevent aircraft groundings due to lack of engines.

(U) TF41: Accelerated mission tests will be conducted to verify/qualify repair procedures and redesigns for durability and reliability improvements. Tasks include developing an improved reliability main fuel pump and main fuel control. Life limit testing will be accomplished. The improvement program for the turbine air seal will be continued. New repair techniques and extension of serviceable limits will be evaluated as part of the engine maturation program.

(U) T56: This program will concentrate primarily on the investigation, definition and correction of service revealed deficiencies preventing engines from achieving the scheduled time between overhaul, resulting in higher logistic support costs. Low cycle fatigue life analysis will be continued and development work for an improved durability high pressure turbine rotor will be accomplished. Effort will be directed toward maintaining engine specification requirements as the engine ages. Maintenance actions will be reviewed to establish/extend inspection limits and to develop repair techniques for field and overhaul activities.

(U) Other Engines: The remaining engines in CIP are relatively more mature and the effort on these programs is directed toward maintaining operational capability with reasonable logistic expense. As the engine ages and accumulate more time, new failure modes are identified and must be addressed. Repair and maintenance procedures are continually reviewed and modified to meet the changing characteristics of the engines.

(U) A continuing program is conducted for each in-service engine. The level of funding for each engine program is derived from a bottoms-up estimate of development costs required to meet the specific engines program objectives and is reviewed by the Engine Advisory Group comprised of technical/management specialists from the Air Force Logistics Command, Air Force Wright Aeronautical Laboratories and Air Force Systems Command. Both the F109 (T-46A) and F110 (F-15/16) engines will be entering the Air Force inventory in FY 1986 and will require CIP support.

(U) Cost estimates are based on contractor proposals plus historically based estimates of support required for each engine. Cost estimates are category IV.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64313F
DOD Mission Area: #476 - Training, Medical, and Other General Support

Title: T-46A (Next Generation Trainer)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		122,174	77,977	54,287	11,348	2,610	336,904

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The T-46 will replace the T-37 in all USAF training roles (including Undergraduate Pilot Training, Undergraduate Navigator Training, and Accelerated Copilot Enrichment for Strategic Air Command). The Air Force is also tentatively planning to replace the T-37 with the T-46 in the Euro-NATO Joint Jet Pilot Training (ENJJPT) program at Sheppard AFB, TX in the early 1990s. The T-46 will be a side-by-side seating, twin engine, pressurized airplane using off-the-shelf equipment when possible. The turbofan engines and airframe technology will be state-of-the-art to reduce development risk and to ensure a fuel efficient training system. Full Scale Development (FSD) contracts were awarded on 2 July 1982 to the Fairchild Republic Company and the Garrett Turbine Engine Company for the airframe and engine developments, respectively. Ground tests are proceeding toward flight certification of the first development aircraft by April 1985.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	122,260	77,977	55,916		14,230	338,973
Procurement	7,900	132,000	218,400		2,750,300	3,108,600

- FY 1986 RDT&E decreased $1.6 million in order to support a higher priority program ($0.6 million) and due to an adjustment to the inflation rate ($1.0 million).

- FY 1986 procurement increased $3.8 million, and the total procurement cost increased $39 million as the result of revisions to the inflation indices. This is the net of the April 1984 change to the outlay rates and the January 1985 change to the inflation rates. Additionally, total procurement cost increased $22 million in order to budget to most likely cost as a result of the most recent Independent Cost Analysis.

Program Element: #64313F
DOD Mission Area: #476 - Training, Medical, and Other General Support

Title: T-46A (Next Generation Trainer)
Budget Activity: #4 - Tactical Programs

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement (PE 84741F):						
Funds	9,175	131,300	222,200	569,300	2,237,700	3,169,675
Quantities	0	10	33	99	508	650

5. (U) RELATED ACTIVITIES: The U.S. Navy plans to replace the T-2C and TA-4J aircraft with a new jet training system. The Navy has selected the British Hawk (T-45) and will use it for the advanced, or second, undergraduate pilot training phase. The T-46, however, will be used in the initial, or primary, Air Force training phase. The Hawk is too complex and has too much performance to be used as an Air Force primary trainer. A Memorandum of Understanding (MOU) concerning trainer development has been signed by both Services. This MOU states that the two aircraft under development will be capable of being used by both Services should the need arise in the next few years. Simulator development for the T-46 is funded in PE 64227F, Flight Simulator Development.

6. (U) WORK PERFORMED BY: The Air Force management of the T-46 is accomplished by the T-46 System Program Office at the Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Fairchild Republic Company (FRC), Farmingdale, LI, NY, and Garrett Turbine Engine Company (GTEC), Phoenix, AZ, were awarded Full Scale Development (FSD) contracts for the air vehicle and engine in July 1982. The Air Force Operational Test and Evaluation Center at Kirtland AFB, NM will manage the Initial Operational Test and Evaluation (IOT&E) of the T-46.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64313F, T-46A

A. (U) Project Description: See paragraph 2.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The incremental Critical Design Review (CDR) was completed in December 1983. Following a successful Air Force Systems Acquisition Review Council (AFSARC) milestone II review on 14 February 1984,

long lead funding for production lot I was released. Fabrication and assembly efforts for Development Test and Evaluation (DT&E) aircraft #1 were initiated on 1 March 1984, followed by the remaining test articles (durability, static loads and DT&E #2). The first test engines began Initial Flight Release testing in July and will be completed in December 1984. Escape system qualification testing began in August 1984 at Holloman AFB. The majority of airframe wind tunnel testing was completed, including verification of the redesigned engine inlet and the wing tip extensions. The metal mockup neared completion and maintenance accessibility demonstrations were initiated.

(2) (U) FY 1985 Program: Final preparations for the first flight of DT&E #1 in April 1985 characterize the first half of FY 1985. Major assembly mating, including engines, will be completed by February 1985, followed by shipment to Edwards AFB for reassembly and pre-flight ground tests. Early flight testing will consist of a three month preliminary overall evaluation to provide a "quick look" assessment of the aircraft. Full scale static and durability testing will begin in mid FY 1985. The second DT&E aircraft will be delivered and will begin flight test in the fourth quarter FY 1985. The contract option for the first production lot was exercised in November 1984, and long lead funding for the second lot was also released.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The flight test program will be at peak activity. Major testing includes flying qualities, stall/post-stall/spin, engine/airframe integration, performance airloads and subsystem (fuel, hydraulic, avionics, etc.) qualification. Climatic testing will be initiated at El Centro Naval Air Station (NAS), CA. Engine Full Flight Release (FFR) testing will be completed in the first quarter FY 1986. The first and second production aircraft will be delivered to Edwards AFB in the third quarter, FY 1986, for a total of five months of dedicated Initial Operational Test and Evaluation (IOT&E) prior to delivery to Laughlin AFB, the Initial Operating Site (IOS). The procurement cost estimate is a category II (mature) cost estimate based upon firm contractor prices for the first two production buys, and based on a December 1983 Independent Cost Analysis (ICA) for subsequent sole source procurement from Fairchild and Garrett.

(4) (U) Program to Completion: The climatic testing will be completed in FY 1987 in the climatic hangar at Eglin AFB followed by a deployment to Eielson AFB, AK. Any remaining development problems and potential fixes will be investigated and resolved. Upon delivery of the twentieth production aircraft to the initial operating site, Lauglin AFB, TX, a two month Operational Readiness Verification will be conducted in late FY 1987 to verify the T-46's ability to meet maintainability requirements.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Mission Element Need Statement	June 1979
(2) (U) Full Scale Development Contract Award	July 1982
(3) (U) Preliminary Design Review	February 1983
(4) (U) Critical Design Review	December 1983
(5) (U) Air Force Systems Acquisition Review Council Milestone II Review (AFSARC)	February 1984
(6) (U) First Development Flight	April 1985
(7) (U) First Production Delivery	April 1986
(8) (U) AFSARC Milestone III Review	October 1986
(9) (U) Initial Operational Capability	September 1987

Budget Activity: 4, Tactical Programs
Program Element: 64313F, T-46A

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The T-46 Development Test and Evaluation (DT&E) program is structured into two major divisions: contractor conducted ground tests and Combined Test Force conducted flight tests. The contractor ground tests are planned, scheduled, directed and conducted by the contractor. These tests include engineering development verification, preflight integration tests and acceptance tests. The Combined Test Force will incorporate contractor and Government test requirements into a single integrated plan, using contractor and Air Force flight crews. This program includes flying qualities tests, structural tests, performance, propulsion and fuel system tests, reliability, maintainability and logistics supportability tests, and technical order verification.

(U) The primary objectives of DT&E are to: verify the design of the T-46 air vehicle and components; verify the performance of the T-46 air vehicle and components; evaluate T-46 support equipment, maintenance and operating procedures; identify T-46 system deficiencies and evaluate potential solutions; acquire data to support the T-46 system production process; and acquire data to assess and support changes to other components of the Undergraduate Pilot Training System.

(U) Two Full Scale Development (FSD) aircraft will be flight tested at Edwards AFB. Except for the Government furnished Airborne Test Instrumentation System (ATIS), the test and production aircraft will be similarly configured.

(U) The T-46 Test Planning Working Group, chaired by the T-46 Program Office test manager, will coordinate and integrate Operational Test and Evaluation into the test program. Members of the Test Planning Working Group are the T-46 Program Office, the F-109 Engine Program Office, Air Force Flight Test Center, Air Force Operational Test and Evaluation Center, Air Training Command, Air Force Logistics Command, Arnold Engineering Development Center, the 6585th Test Group, and the contractors. The Air Force Systems Command Program Director is Col Victor Genez. The airframe and engine contractors are Fairchild Republic Corporation and Garrett Turbine Engine Company, respectively.

(U) Data on reliability, maintainability, availability and logistics supportability will be acquired on operationally representative equipment during flight tests using the Air Force Flight Test Center System Effectiveness Data System. During the first half of the Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/OT&E) effort, Air Force personnel will perform "over-the-shoulder" and "hands-on" maintenance under the contractor's supervision. In order to make an initial assessment of the T-46 maintenance concept, Air Force personnel will perform all maintenance during the latter part of DT&E/IOT&E.

Budget Activity: 4, Tactical Programs
Program Element: 64313F, T-46A

2. (U) Operational Test and Evaluation (OT&E): The Air Force Operational Test and Evaluation Center (AFOTEC) has been directed to manage both the Initial Operational Test and Evaluation (IOT&E) portion of the combined DT&E/IOT&E, as well as the dedicated IOT&E of the T-46. The T-46 IOT&E will be conducted to evaluate the T-46's operational effectiveness and suitability in order to identify operational deficiencies and the need for any modifications.

(U) The suitability evaluation will be conducted during the entire DT&E/IOT&E test program and will focus on the T-46's reliability, maintainability, and availability. Combined DT&E/IOT&E is scheduled for April 1985 to July 1986.

(U) The effectiveness evaluation will consist of 90 dedicated IOT&E sorties, using the first two production aircraft, and will focus on the operational effectiveness of the T-46 as a primary trainer. During the dedicated IOT&E sorties, 6 Air Training Command (ATC) T-37 instructor pilots will receive 15 sorties each, flying missions as outlined in the ATC training syllabus. Dedicated IOT&E is scheduled for April 1986 through July 1986. The Air Force Systems Acquisition Review Council (AFSARC) milestone III review is scheduled for the fall of 1986.

3. (U) Systems Characteristics:

Characteristics	Objectives	Demonstrated
Critical Field Length	5,000 feet (maximum) with reduced thrust (formation takeoff power setting, 5,000 feet pressure altitude, 100°F, 10 knot tailwind)	To be determined
Single engine takeoff climb gradient	3.5% (takeoff configuration, 5,000 feet pressure altitude, 100°F)	To be determined
Climb capability	2,000 feet per minute rate of climb at 25,000 feet	To be determined
Cruise altitude	Sustained cruise up to 35,000 feet	To be determined
Cruise speed	300 KTAS minimum at 25,000 feet	To be determined
Mission	Fuel for 1.5 hour formation flight at 15,000 feet, instrument approach, 300 nautical mile diversion to alternate airfield	To be determined
Landing approach speed	90 to 110 knots	To be determined

Budget Activity: 4, Tactical Programs
Program Element: 64313F, T-46A

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Wind tunnel testing	1982 - 1984	1982 - ongoing	Aerodynamics, flutter and spin characteristics determined.
Escape system tests	March - November 1984	March 1984 - ongoing	Canopy jettison qualification completed.
Engine Initial Flight Release (IFR) Tests	June - August 1984	July - December 1984	Schedule slip due to design change.

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Airframe tests		
Durability (2 lifetimes)	April 1985 - March 1986	One lifetime by Oct 85
Static loads	June 1985 - October 1986	150% limit load by Nov 86
Engine Full Flight Release (FFR) tests	April - November 1985	
DT&E/IOT&E flight test		
First flight (DT&E #1)	April 1985	
Preliminary overall evaluation	April - June 1985	Overall "quick look" at key technical objectives
Delivery DT&E #2	July 1985	
Dedicated IOT&E	April - July 1986	Production aircraft #1 and #2

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64314F
DOD Mission Area: #221 - Counter Air

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		190,652	209,749	101,382	1,070*	0*	850,185*
3096	AMRAAM	188,538	209,749	88,282	0	0*	833.548*
3097	HAVE SPEAR	2,114	0	13,100	1,070*	0*	16,637*

* These values are subject to change. A thorough review of the entire AMRAAM program is underway. Once this review is complete, the FY 1987 and out budget will be adjusted to reflect the approved program.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The US and North Atlantic Treaty Organization (NATO) tactical air forces urgently require a high performance air-to-air missile to help compensate for the numerical advantage of Warsaw Pact fighter/interceptor aircraft. Thus, this joint Air Force/Navy program is structured in response to the Joint Service Operational Requirement (JSOR) and Mission Element Need Statement (MENS) to significantly improve operational utility and combat effectiveness through development of a follow-on to the AIM-7 SPARROW air superiority, air-to-air missile. A NATO Staff Target titled "Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond" has identified a nearly identical requirement. The need described in these documents is for an all weather, all aspect, all environment air-to-air missile compatible with the F-14, F-15, F-16, F/A-18 and appropriate NATO air superiority and air defense aircraft. The missile must have a launch and maneuver employment capability, provide the attacking aircraft with the capacity for multiple target attack during a single intercept thus reducing friendly aircraft attrition in medium range air-to-air engagements, a performance envelope significantly improved over the AIM-7F/M, and increased missile velocity. AMRAAM, designated the AIM-120A, will satisfy these needs. AMRAAM Full Scale Development (FSD) is funded under this program element.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total
RDT&E	186,735	217,749	103,401		1,193	852,626
Missile Procurement (27163F)						
Funds	57,939	430,987	842,911		5,373,700	6,705,500
Quantities	0	174	1,042		15,907	17,123
Missile Procurement (78011F)						
Funds (Industrial Preparedness)	10,200	1,995	0		0	25,295
Quantities	Not Applicable					

Program Element: #64314F
DoD Mission Area: #221 - Counter Air

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: #4 - Tactical Programs

(U) EXPLANATION OF DIFFERENCES: RDT&E ($ in thousands) - The FY 1984 increase was USAF reprogramming to continue HAVE SPEAR study efforts (2,114) and to meet some Full Scale Development (FSD) funding shortfalls (1,803). The FY 1985 decrease (8,000) was due to a Congressional reduction of the HAVE SPEAR project. Economic adjustments for inflation have affected FY 1984 through FY 1987.

(U) Missile Procurement (27163F) ($ in thousands) - The FY 1985 change reflects an Air Force reduction of the production quantitiy to zero to concentrate on preproduction efforts. The FY 1986 change and remaining costs reflect a rephasing of the production program to accommodate slips in the FSD program. Total estimated costs reflect the latest program estimate supported by an independent cost analysis (ICA) completed in FY 1985. Missile Procurement (78011F) - This PE contains funds for Technical Modernization (Tech Mod) of the Hughes Aircraft Company's Tucson production facility where AMRAAM is one of the several missile systems under production. The FY 1984 figure gives the total funds in the PE for Tech Mod but only 2,000 are AMRAAM specific. In FY 1985, AMRAAM specific funds were zeroed.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement (PE 27163F)						
Funds	57,839	73,135	438,489	854,831*	6,969,559*	8,393,853*
Quantities	0	0	90	505	16,528	17,123
Missile Procurement (PE 78011F)						
Funds (Industrial Preparedness)	2,000	0	0	0	0	17,095
Quantities	Not Applicable					

* These values are subject to change. A thorough review of the entire AMRAAM program is underway. Once this review is complete, the FY 87 and out budgets will be adjusted to reflect the approved program.

5. (U) RELATED ACTIVITIES: The Advanced Medium Range Air-to-Air Missile development program is a Joint Service effort with the Air Force as Executive Service and Navy personnel integrated into the Joint System Program Office (JSPO). The Navy has assigned: the Deputy Program Manager, the Assistant Chief Engineer, and various other assistants for logistics, budget, project management, and test. The Joint System Program Office is maintaining a close relationship with the F-14 (PE 25667N), F-15 (PE 27130F), F-16 (PE 27133F), and F/A-18 (PE 24136N) program offices to assure proper implementation of the aircraft modifications required to employ AMRAAM. The AMRAAM Validation Phase was funded under Program Elements 63370F and 63370N. Funding for Navy peculiar Full Scale Development requirements and Operational Evaluation is included in Program Element 64314N. Air Force procurement of AMRAAM is funded under Program Element 27163F beginning in fiscal year 1984. This Program Element also funds pre-planned product improvement (P^3I) as an ongoing effort starting in FY 1987. Other related programs include target identification and processing techniques.

6. (U) WORK PERFORMED BY: The Advanced Medium Range Air-to-Air Missile development and acquisition program is being managed by the AMRAAM Joint System Program Office at the Armament Division, Eglin Air Force Base, FL. In addition to the Armament Division, other government organizations/facilities participating in the development effort include the Air Force Armament and Test Laboratory Eglin AFB, FL; White Sands Missile Range, NM; Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, Air Force Materials Laboratory, Wright-Patterson Air Force Base, OH; Pacific Missile Test Center, Naval Air Station, Pt Mugu, CA; and Naval Weapons Center, China Lake, CA. Hughes Aircraft Company, Canoga Park, CA, was selected as the prime contractor for full scale development (FSD) and as leader for initial production (under a leader-follower concept) of AMRAAM. Raytheon Company, Bedford, MA, was awarded a follower contract to learn the AMRAAM system from Hughes during FSD and to become the eventual second source competitive producer of AMRAAM.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3096, AMRAAM

A. (U) Project Description: The AMRAAM development effort has the objective of significantly increasing United States and North Atlantic Treaty Organization (NATO) air-to-air capability by producing a more effective, reliable, affordable, and maintainable missile, with emphasis on engagement and destruction of very low altitude and high altitude/high speed targets in an electronic countermeasures environment. To satisfy the Mission Element Need Statement, Joint Service Operational Requirement, and NATO Staff Target, the proposed AMRAAM design utilizes various guidance modes which include inertial midcourse guidance (can be updated in flight) and active radar terminal guidance. Key features which will improve operational utility of the missile include: capability for multiple target attack by the aircraft, launch and maneuver capabilities, high average missile velocity, improved missile envelope over the AIM-7 SPARROW, and increased maneuverability. Mature technologies, such as solid state electronics, high rate digital computers, and terminal guidance-aided fuzing are featured. Of prime importance is the requirement for the AMRAAM to be totally compatible with the fire/weapons control systems of the F-14, F-15, F-16, and F/A-18. Germany plans to employ AMRAAM on the F-4F, and the United Kingdom on the Tornado F2 and the Sea Harrier.

(U) Two contractors were selected for a competitive Validation Phase beginning in February 1979. To validate their Advanced Medium Range Air-to-Air Missile concepts, each contractor conducted extensive ground component testing, simulation, captive carry, and free flight testing. Based on the results of validation tests and the contractors' proposals, Hughes Aircraft Company of Canoga Park, CA, was awarded a contract for the FSD of their design, including development/modification of launchers. Rail launchers will be developed to provide the necessary aircraft/missile interfaces and will be capable of AMRAAM and AIM-9 SIDEWINDER carriage without modification. Current SPARROW ejection launchers will be modified so that they have both an AMRAAM and a SPARROW capability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Hughes Aircraft Company continued the full scale development (FSD) design work and ground testing of the AMRAAM. Class II modifications to make the aircraft capable of carrying AMRAAM captive equipment (ACE-1) and launching the missile were completed on the F-15 and F-16. Class V modifications on these aircraft began. The flight test program began; F-16 instrumented measurement/captive load vehicle testing was completed. The ACE 1 pod was delivered and flight testing on the F-15 began. Missile software development and evaluation began using the F-15 test bed. Raytheon continued to review the AMRAAM procurement data package and did production planning.

(2) (U) FY 1985 Program: The combined development test and evaluation/initial operational test and evaluation (DT&E/IOT&E) program to verify that missiles meet specifications and to make an early operational assessment began in FY 1985. The successful live firing of separation/control test vehicle #1 on 7 December 1984 met all mission objectives. Also scheduled to begin in FY 1985 are the guided test vehicle launch program beginning with the F-16 and continuing with the F-15 and F/A-18; the Captive Carry Reliability Program (CCRP) (an "on-airplane" carriage of missiles to determine reliability as a function of flight time); and the Test, Analyze, and Fix (TAAF) program (environmental laboratory tests simulating captive flight profiles to determine reliability problems and fixes). The Critical Design Review is scheduled for completion during February 1985. As a result of FSD schedule slips, in January 1985 the Air Force extended the 50 month contracted development period to approximately 72 months. Because of FSD delays, the Department is concerned about the potential for cost growth in the production program. As a result, a number of production cost containment exercises were begun. These include increasing competition in the program, enhancing the producibility of the missile, and seeking ways to simplify the missile design. As part of this initiative, producibility study contracts were awarded to Hughes and Raytheon in February 1985. The Air Force is committed to not making a production decision until a thorough review of all possible options is complete; anticipated to occur in the summer 1985. If costs are adequately controlled, the Air Force may contract for the advance buy items for the Lot I low rate initial production (LRIP) in late 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: DT&E/IOT&E on the F-16 and F-15 and DT&E on the F/A-18 and F-14 will continue in FY 1986. The TAAF program and the F-16 CCRP will be completed. Depending upon the success of FY 1985 cost control measures, low rate initial production may be pursued for 90 missiles (70 missiles to the leader and 20 missiles to the follower). Also, advance procurement for FY 1987 may be pursued. The RDT&E cost for the program is based on a program office estimate accomplished in FY 1982 and verified by a independent cost analysis (ICA) in FY 1983. The emphasis will continue on reducing AMRAAM production costs through the producibility enhancement program, simplifying missile design, and acceleration of the follower to obtain the earliest possible competition.

(4) (U) Program to Completion: The restructured FSD program recognizes hardware and software schedule slips and elongates the contracted schedule from 50 to approximately 72 months. FSD problems are not of a serious technical nature but are due to the extensive scope of the effort and the ambitious pace originally established. The government will incur no FSD contractor costs above the current fixed price contract ceiling for the original work contained in the contract. Additional FSD government support in FY 1987 and beyond to support a 72 month schedule may be required; that determination is pending a program decision expected in the summer of 1985. While the FSD content remains essentially unchanged, we are currently in the process of rephasing this effort.

C. (U) Major Milestones:

Milestones		Dates
(1) Start Design Definition		October 1976
(2) Complete Design Definition		May 1977
(3) Start Pre-prototype Evaluations		July 1978
(4) Complete Pre-prototype Evaluations		September 1978
(5) Milestone I		November 1978
(6) Award Validation Phase Contracts		February 1979
(7) Validation Phase Complete		November 1981
(8) Award Full Scale Development (FSD) Contract		December 1981
(9) Full Scale Development Subsystem Tests Start		May 1982
(10) Preliminary Design Review		August 1982
(11) Milestone II		September 1982
(12) Full Scale Development Flight Tests Start (Missile Free Flight)	*(March 1984)	December 1984
(13) Full Scale Development Flight Tests End	*(February 1986)	TBD
(14) First Production Delivery	*(September 1985)	TBD
(15) Initial Operational Capability	*(September 1986)	TBD

* Date presented in FY 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES:

(12) (U) Delays in the FSD program changed the availability of the first flight test missile.

(13-15) (U) These dates are tentative as negotiations are underway to realign the existing FSD contract with actual contractor performance and the Department of Defense is reviewing the proposed program restructure. These milestones will be finalized upon completion of negotiations.

9. (U) PROJECTS OVER $10 MILLION IN FY 1986:

(U) Project: 3097, HAVE SPEAR

(U) Project Description: Details on this project require limited access.

Budget Activity: 4, Tactical Programs
Program Element: 64314F, Advanced Medium Range Air-to-Air Missile (AMRAAM)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): Development of AMRAAM is being managed by the AMRAAM Joint System Program Office (JSPO) at Eglin AFB, FL, under the command of the Armament Division of the Air Force Systems Command. The 3246th Test Wing at the Armament Division is the Responsible Test Organization (RTO) for DT&E. The Test Wing formed a Joint Air Force/Navy Test Force to conduct the combined DT&E and Initial Operational Test and Evaluation (IOT&E). The Air Force Operational Test and Evaluation Center (AFOTEC) will have overall management responsibility for separate AMRAAM IOT&E and the dedicated OT&E events scheduled during the combined DT&E/IOT&E phase.

(U) Following the completion of concept definition and Milestone I (November 1978), contracts were awarded to Hughes and Raytheon on 2 February 1979, for the competitive Validation Phase. In early fiscal year 1982, Hughes was selected to begin Full Scale Development (FSD). Milestone II was held in September 1982, after completion of the system Preliminary Design Review.

(U) Validation Phase test and evaluation was initiated early in fiscal year 1980 and included a variety of ground captive carry and free flight testing intended to provide data necessary for management to confirm that the AMRAAM concept was sound and that the technical risks in proceeding with FSD were acceptable. To facilitate the validation testing, each of the competing contractors developed their own missile design and fabricated hardware which matured in design from early checkout vehicles to prototype AMRAAMs.

(U) Each contractor's prototype hardware was tested to examine its potential for satisfying the Joint Service Operational Requirements such as improved end game performance, look-down-shoot-down capabilities, multimode guidance flexibility, enhanced electronic counter-countermeasures potential, multi-aircraft compatibility and reliability and performance goals. Included in the free flight testing were demonstrations of AMRAAM's unique autonomous guidance mode, as well as a command-inertial active guidance mode. The following results were achieved with the major test assets:

(U) Instrumented Measurement Vehicle - These test assets were designed to measure temperature and vibration characteristics of the missile and launcher during carriage aboard the various aircraft. Hughes Aircraft Company hardware was tested from November 1979 through October 1981; the missions flown included ten on the F-14, 19 on the F-15, and 17 on the F-16. Raytheon Company hardware was tested from June 1980 through May 1981; the missions flown included eight on the F-14, 17 on the F-15, and seven on the F-16. The Instrumented Measurement Vehicle tests aided the development of the data base for the FSD Test, Analyze, and Fix reliability program and resulted in a physical strengthening of the missile airframe and rail launcher.

(U) Seeker Test Unit (STU) - These test assets were used for development and evaluation of the seeker and guidance subcomponents. Hughes Aircraft Company hardware was tested from December 1979 through September 1982. One hundred eighteen missions were flown to evaluate all design functions of the weapon system with the exception of complex electronic countermeasure waveforms. Waveform studies were conducted at the simulation facility, Army Missile Command, Redstone Arsenal, Alabama. Raytheon Company hardware was tested from December 1980 through November 1981. Twenty-four missions were flown to evaluate the Raytheon seeker. The Seeker Test Unit tests resulted in an improved data link code to prevent interference between aircraft and missiles, an improved initialization algorithm for operation in heavy clutter environments and various improvements in seeker acquisition and tracking algorithms.

(U) Separation and Controlled Test Vehicles - These tests were used to provide separation and airframe control data. Hughes Aircraft Company launched four separation test vehicles between June 1980 and October 1981. Raytheon company launched two control test vehicles between January and April 1981. A launch latch release problem was encountered in the Raytheon design and corrected.

Guided Test Vehicles (GTV) -- These test assets were used to demonstrate improved end game performance, look-down-shoot-down capabilities, multimode guidance flexibility, electronic counter-countermeasure potential, compatibility with the F-14, F-15, and F-16 aircraft, and to develop reliability and performance data. The 1981 test plan had a schedule of ten Guided Test Vehicle firings by each contractor. However, additional use of the Seeker Test Unit and selection of Hughes as the design leader reduced the required number of firings to six. These were launched between June 1981 and September 1982. Although all flight tests were not completely successful, all test objectives were met. The Validation Phase Guided Test Vehicle testing made possible improvements to the system's electrical, software, and mechanical design. The only major subcomponent that was not tested as an integrated unit was the Hughes target detection device (fuze). Target detection devices developed by each contractor were tested at the Navy's Encounter Simulation Lab, Corona, California.

(U) During validation, data were collected to aid the design, to prove the weapons system concept, and support answers to the critical issues. The test hardware used during the Validation Phase was functionally the same as that planned for Full Scale Development (FSD); however, the transmitter design was changed from solid-state to a Traveling Wave Tube (TWT). The change reduces technical risk since the AMRAAM TWT is an adaptation of a TWT used in existing electronic warfare equipment. In addition, TWTs in an AMRAAM configuration were laboratory tested by Hughes during validation. Design changes during FSD will result in lower cost, producibility, and improved reliability. The FSD plan calls for 87 missile firings to accomplish combined Development and Initial Operational Test and Evaluation of AMRAAM using the F-14, F-15, F-16 and F/A-18 aircraft. Four of these missiles will have warheads. Captive carry vehicles will be used similarly to those used during the Validation Phase. In addition, seven missiles will be produced for laboratory reliability testing and ten firing assets will be used for a concentrated Captive Carry Reliability Program (CCRP) on the F-16 and F-15.

Budget Activity: 4, Tactical Programs
Program Element: 64314F, Advanced Medium Range Air-to-Air Missile (AMRAAM)

(U) In-depth FSD phase test and evaluation was initiated in October 83. Testing accomplished to date includes aircraft/missile environmental testing using FSD configuration instrumented measurement vehicles, aircraft/missile integration and wing twist (F-16 only) evaluation using the initialization/alignment vehicles, and missile software development/evaluation using the AMRAAM Captive Equipment (ACE-1) pod (brass board hardware) on the F-15. Environmental testing includes F-16/AMRAAM flutter and loads, vibration, and stability and control evaluations. Additionally, environmental testing of the AMRAAM on the F-15 rail stations has been initiated. Captive test using the ACE pod has resulted in verification of the initial software which was used in the first Separation/Control Test Vehicle launch from the F-16 on 7 Dec 1984, and the first two AAVIs (AMRAAM air vehicle, instrumented; analogous to Validation Phase Guided Test Vehicle (GTV), checkout of numerous FSD configuration missile components, and evaluation of initial FSD software block improvements.

(U) Col Thomas R. Ferguson is the Air Force Program Manager for AMRAAM. The Leader contractor is Hughes Aircraft Company and the Follower is Raytheon Company.

2. (U) Operational Test and Evaluation (OT&E): No AMRAAM OT&E has been accomplished to date. The OT&E will start in the third quarter of FY 1986 and will consist of a combined development test and evaluation/initial operational test and evaluation (DT&E/IOT&E) and a separate IOT&E captive carry program of the AMRAAM on the F-15 and F-16 aircraft. Air Force is the lead service and the Air Force Operational Test and Evaluation Center (AFOTEC) is the OT&E test agency.

(U) The IOT&E planning accomplished to date consists of the integration of DT&E and IOT&E test requirements under the combined T&E format. The AFOTEC IOT&E test plan is being written and will be published in FY 1985. The combined DT&E/IOT&E program will consist of approximately 87 total missile firings from the F-14, F-15, F-16, and F/A-18 aircraft. These missiles are preproduction test articles. The separate IOT&E of the F-15/AMRAAM system will be a comprehensive Captive Carry Reliability Program (CCRP) designed to evaluate reliability of the system. This separate IOT&E will be concurrent with the combined testing.

(U) OT&E live firings will occur at White Sands Missile Range, New Mexico, and the Eglin Gulf Test Range, Florida. The CCRP will be conducted on operational F-15 and F-16 missions from Nellis AFB, Nevada.

(U) OT&E reports published:

(1) AMRAAM Operational Utility Evaluation Final Report, August 1982 (Secret).

(2) AMRAAM Operational Utility Evaluation Data Supplement, February 1983 (Secret).

Budget Activity: 4, Tactical Programs
Program Element: 64314F, Advanced Medium Range Air-to-Air Missile (AMRAAM)

3. (U) System Characteristics: The missile is being defined in response to the Mission Element Need Statement, Joint Service Operational Requirement and the Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond. The objectives data listed below are tentative and reflect Joint Service Operational Requirement, system specification, and the Secretary of Defense Decision Memorandum thresholds.

a. Performance	Goals/Threshold	Demonstrated
Speed (maximum mach)		To be demonstrated
Altitude (feet)		
Maximum		To be demonstrated
Minimum		To be demonstrated
Range		
Maximum (nautical miles)		To be demonstrated
Minimum (feet)		To be demonstrated
Kill Probability (percent)		To be demonstrated

b. (U) Reliability

Mean Time Between Maintenance (hours)	600-450	To be demonstrated
Operational Reliability (Free Flight)	.9-.85	To be demonstrated

c. (U) Missile Description

Launch Weight (pounds)	335 +/- 3
Guidance Type	Active radar terminal/inertial mid-course
Compatibility	F-14, F-15, F-16, F/A-18, F-4F (German), Tornado (British), Sea Harrier (British)

Budget Activity: 4, Tactical Programs
Program Element: 64314F, Advanced Medium Range Air-toAir Missile (AMRAAM)

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Combined DT&E/IOT&E			
- Environmental	August 83	October 83	50% complete (F-16 program 70% complete)
- AMRAAM Captive Equipment (ACE)	December 83	February 84	Tape 1 evaluation complete (software for AMRAAM Aeronautical Vehicle Instrumented 1&2 and Separation/Control Test Vehicle); Tape 2 in final evaluation on ACE-1
- S/CTV	December 84	December 84	

T&E Activity (Next 12 Months)

Event	Flannned Date	Remarks
Air Force Systems Acquisition Review Council III A	TBD	Lot I advance buy
Combined DT&E/IOT&E Live Firings begin	March 85	
- AAVI	March 85	
Critical Design Reviews complete	NLT February 85	
Separate IOT&E events begin	February 85	
AFSARC IIIB	TBD	Lot II production buy

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64321F Title: Joint Tactical Fusion Program
DOD Mission Area: #322 - TIARA for Tactical Land Warfare Budget Activity: #4 - Tactical Programs

1. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces have a need to rapidly (on a Near Real Time basis) exploit time-sensitive and high volume multi-sensor information. The objective of this program is to develop and field an Enemy Situation Correlation Element (ENSCE) by [ ] which will correlate and aggregate multi-source sensor data; provide precise location of opposing force structure and provide ground battle situation displays to support the Tactical Commanders. Information will be shared with the Army All-Source Analysis System (ASAS).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,713	17,787	22,761		55,000	105,756

Program repricing based on restructure of the program and an updated Baseline Cost Estimate.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The Joint Tactical Fusion Program is developing the Air Force's Enemy Situation Correlation Element (ENSCE) and the Army's All Source Analysis System (ASAS). The Army is the Executive Agent for this Joint Program. The ASAS and ENSCE are essential in attaining an effective, interoperable, and coordinated intelligence/combat information system. The Joint Tactical Fusion Program is also a major component of the Interdiction Program which is integrating several joint programs. Army and Air Force have agreed on a cost sharing for RDT&E of 12.8% for Air Force and 87.2% for Army.

6. (U) WORK PERFORMED BY: The Jet Propulsion Laboratory (JPL), California Institute of Technology, Pasadena, California has been selected as the systems integration contractor and as much as 80% of the JPL effort will be subcontracted. Subcontractors include TRW, Mc Lean; VA, McDonnell Douglas, St Louis, MO; HRB Singer, Little Falls, NJ; Ford Aerospace Corp, Lexington, MA; Martin Marietta, Bethesda, MD; Analytics, McLean VA; and MITRE Corp, Bedford MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64321F, Joint Tactical Fusion Program

A. (U) Project Description: The employment of highly mobile and technologically advanced weapons systems by opposing tactical military forces requires early detection, identification and location. To support this requirement, sophisticated intelligence sensor systems which can detect and locate enemy information and threat systems are being deployed in increasing numbers. There is a critical need to rapidly exploit this time-sensitive, high volume sensor information and to effectively control and manage organic sensor and electronic warfare assets. The purpose of this accelerated program is to develop and field an All Source Analysis System (ASAS) for the Army and the Enemy Situation Correlation Element (ENSCE) for the Air Force. The program will provide the Services with the capability to correlate and aggregate the large number of elements detected by various sensor systems, reduce them to force structures, produce ground-battle situation displays, provide target nomination and intelligence support, and manage and control sensor and electronic warfare assets. In December 1980, the Office of the Secretary of Defense submitted to Congress a joint Service/agency-generated Joint Tactical Fusion Development and Acquisition Program Plan. This plan combined the Battlefield Exploitation and Target Acquisition (BETA) project, the Air Force Enemy Situation Correlation Element (ENSCE) (formerly the Automated Tactical Fusion Division (ATFD)),the Army Tactical ATFD, the Army Technical Control and Analysis Center (TCAC), and the Tactical Simulator (TACSIM) programs into a Joint Tactical Fusion Program with the Army as the lead Service. The current approved acquisition strategy is based on an evolutionary approach, with extensive user involvement from field operating units. It takes existing service baseline requirements develops hardware for the tactical environment, and provides for the incremental development of software that reflects user needs, experience and priorities. The evolutionary software development proceeds from baseline operating and data base management systems to the development of expanded applications software that handles the full spectrum of ASAS/ENSCE requirements. The hardware development reflects a baseline set, appropriately specified in terms ot equipment functions, which accommodates the software being developed and evolves to encompass technical and operational product improvements. This evolutionary approach to development is consistent with DOD Directive 5000.1, DOD Instruction 5000.2, and DOD initiatives to reduce the costs of acquisition programs. As directed, the Joint Tactical Fusion Program Management Office (JTFPMO) also monitors, participates in, coordinates, and implements all related intelligence fusion programs. These include the BETA derived systems, such as Limited Operational Capability Europe (LOCE), the Limited ENSCE (LENSCE), the Technical Control and Analysis Center (TCAC), the Near Term Intelligence and Electronic Warfare (IEW) Microprocessor Program (MICROFIX), the 9th Infantry Division Distributed Command and Control efforts (Intelligence Subsystems), the Relocatable Army Processors of Intelligence Data - Europe (RAPIDE), the Korean Intelligence Support System (KISS), the Tactical Simulation Program (TACSIM), the fusion analysis techniques effort and the IEW Subsystem Engineering efforts with the U. S. Army Electronics Research and Development Command (ERADCOM).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: In FY 1984, the ASAS/ENSCE program definition phase was completed, and the implementation phase began. Collateral software development facilities and a Man-Machine Laboratory were completed to support the development process, and a secure software development facility was near completion at year end. The expert users forums addressed all major intelligence functions (e.g., Collection Management, Situation Development,

All Source Analysis, Target Development, etc.) and validated and prioritized the processes and sub-processes. Results of this effort are now being included in training and doctrine. Additionally, software development is progressing as validated and prioritized by these forums. This phase also witnessed the introduction of major subcontractor involvement in software development finalization of the system design, and the initiation of prototype hardware assembly. Support of the Limited Operational Capability Europe (LOCE), the Limited Enemy Situation Correlation Element (LENSCE), and the Technical Control and Analysis Center (TCAC), Battlefield Exploitation and Target Acquisition (BETA) derived systems, and overall intelligence fusion architecture efforts continued.

(2) (U) FY 1985 Program: The All Source Analysis System and the Enemy Situation Correlation Element (ASAS/ENSCE) program will deliver brassboard hardware (ASAS/ENSCE Interface Module (AIM)) to a lead US Army Division for test evaluation and operational employment. This delivery will provide both a field test environment and the intelligence subsystem for the Army Development and Employment Agency's Distributed Command and Control System. In conjunction with ASAS/ENSCE applications software development, software modules for U. S. Air Forces, Europe and Pacific Air Force (USAFE/PACAF) Host Intelligence computers will be developed. This software will provide a needed fusion capability for the Air Force, an early test bed environment for feedback to the program office, and have potential applicability to US Army Echelon Above Corps (EAC) activities. Equipment acquisition will begin for the other ASAS/ENSCE modules (Intelligence Data Processor, Communications Processor and Interface, and the Forward Sensor Interface and Control Support to MICROFIX, Technical Control and Analysis Center(TCAC), Limited Operational Capability Europe (LOCE) Limited Enemy Situation Correlation Element (LENSCE) and intelligence fusion architecture will continue. Major subcontracts for hardware module development and integration will be awarded in the first quarter of the fiscal year to complete the JPL-in-Industry team.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The ASAS/ENSCE project effort will continue the equipment acquisition started in FY 1984 and 1985. The FY 1986 acquisitions will continue hardware procurement and engineering contracts for major elements of the baseline systems. Two AIM modules and associated Microworkstation will be fielded with a lead division as a limited capability ASAS. The first Forward Sensor Interface and Control (FSIC) module will also be delivered for early testing in a field environment. Together, the AIM for the Army and the USAFE/PACAF software modules will be major steps forward in providing early limited capability for both services as the first phase of the evolutionary fielding of baseline ASAS/ENSCE systems. Test and evaluation of the AIM and FSIC modules will lead to limited procurement of these modules in FY 1987. Finally, the USAFE/PACAF applications software modules will be fielded. Support to other JTFP activities/functions will continue. It is essential in view of the Army FY 1985 decrease that the FY 1986 funding remain stable in order to maintain schedule integrity and to purchase items to ensure availability for 1987 system deliverables.

(4) Program to Completion: Development of ASAS/ENSCE will continue with the objective of fielding a baseline ASAS/ENSCE system beginning in [ ] additional baseline modules and software in [ ] and achieving limited procurement for all ASAS/ENSCE modules in [ ] The objective systems will be evolutionary outgrowths of their predecessors.

Program Element: #64321F Title: Joint Tactical Fusion Program
DOD Mission Area: #322 - TIARA for Tactical Land Warfare Budget Activity: #4 - Tactical Programs

C. Major Milestones:

Milestones	Dates
(1) (U) Joint Program Charter signed by the Sec Air Force and Army	February 1982
(2) (U) Limited Operational Capability Europe (LOCE)	December 1982
(3) (U) Limited Enemy Situation Correlation Element for the 9th Tactical Reconnaissance Squadron	April 1984
(4) USAFE and PACAF Software Modules	
(5) Baseline Enemy Situation Element (ENSCE)	
(6) Production ENSCE Delivery	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64362F
DOD Mission Area: #242 - Theater-Wide Nuclear Warfare

Title: Ground Launched Cruise Missile
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		36,067	18,654	685	490	0	384,296

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of the Ground Launched Cruise Missile (GLCM) is to counter modernization of Soviet long-range theater nuclear forces, particularly SS-20s and Backfire bombers. The need is for a highly survivable system with enough range to reach targets in the western military districts of the Soviet Union, thus helping to deter a combined Warsaw Pact and Soviet force which has numerical superiority in both conventional and theater nuclear forces. This program element provides for full scale development to adapt the TOMAHAWK cruise missile into a tactical mobile ground launched system.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	36,167	18,654	0		0	383,817
Missile Procurement	592,002	580,158	666,534		144,046	2,981,020

(U) The additional FY 1986 RDT&E requirement (+$0.7 Million) is to continue the material improvement program.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Missile Procurement: (PE # 27314F)						
Funds*	592,044	572,332	555,175	240,878	0	2,956,800
Quantity	(120)	(120)	(95)	(76)	(0)	(560)

* with initial spares

Program Element: #64362F
DOD Mission Area: #242 - Theater-Wide Nuclear Warfare

Title: Ground Launched Cruise Missile
Budget Activity: #4 - Tactical Programs

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Military Construction (excludes schools, family housing & NATO funded operations facilities)	74,510	19,039	63,873	78,321	13,717	402,760
Department of Energy Costs						

5. (U) RELATED ACTIVITIES: The Ground Launched Cruise Missile program adapts the Navy TOMAHAWK missile, PE 64367N, to a tactical mobile ground launched system. The Air Launched Cruise Missile (ALCM), PE 64361F, is a related cruise missile program.

6. (U) WORK PERFORMED BY: The Joint Cruise Missiles Project Office located in Washington, D.C. has overall responsibility for the Ground Launched Cruise Missile development and testing. The January 1977 Cruise Missile Defense Systems Acquisition Review Council II direction established the Joint Cruise Missiles Project Office with the Navy as lead Service to manage current cruise missile development with special emphasis placed on commonality between programs. The Air Force Ground Launched Cruise Missile Project Office is staffed by the Air Force within the overall auspices of the Navy Director, Joint Cruise Missiles Project Office, who is the Program Manager. Air Force Systems Command, Andrews AFB, MD and Aeronautical Systems Division, Wright-Patterson AFB, OH, interface and support this development activity. The Air Force Operational Test and Evaluation Center, Kirtland AFB, NM, and the Tactical Air Command, Langley AFB, VA, are responsible for operational test and evaluation. The Utah Test and Training Range is the Ground Launched Cruise Missile primary test site. General Dynamics, San Diego, CA, is the contractor for the TOMAHAWK missile airframe. McDonnell Douglas, St Louis, MO, is the navigation/guidance contractor. To expand the cruise missile industrial base, both General Dynamics and McDonnell Douglas are being qualified as dual sources for the all-up-round (missile airframe and guidance). Williams International, Walled Lake, MI, is the contractor for the engine with Teledyne, Toledo, OH, as a dual source for the engine. General Dynamics is the weapons system integration contractor. GTE Sylvania is the communications subcontractor. Vitro, Silver Spring, MD, is the weapons control system software and integrating contractor with McDonnell Douglas, St Louis, MO, providing the hardware.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 64362F, GROUND LAUNCHED CRUISE MISSILE (GLCM)

A. (U) Project Description: The three primary elements of the GLCM system are the missile, the Transporter Erector Launcher (TEL), and the Launch Control Center (LCC). The missile is a variation of the TOMAHAWK (BGM-109) cruise missile currently being produced by the Navy. The TEL consists of a launcher containing four missiles which, along with associated electronic and power production equipment, is mounted on a semi-trailer. The LCC shelter is also mounted on a semi-trailer. It houses the missile launch crew and the equipment necessary for communications, missile status monitoring and missile launch. The design of the TEL, LCC, weapons control system hardware/software, and associated electronics comprise the bulk of the program. System integration and testing make up the balance of the effort.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Completed nuclear certification of Initial Operational Capability software. Began support for Follow-On Operational Test and Evaluation. Began development of Full Operational Capability (FOC) software improvements. Continued integrated logistics support program, reliability and maintainability improvements in the launch equipment.

(2) (U) FY 1985 Program: Primary efforts are the completion of depot logistics development, continued FOC software development and FOC software nuclear certification, reliability and maintainability improvements in the launch equipment, and electromagnetic pulse testing of the launch equipment.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 Request: Consists of reliability and maintainability data analysis to identify and implement materiel improvement projects. Completion of FOC software development and launch equipment improvements with nuclear certification.

(4) (U) Program to Completion: Completion of materiel improvement projects to establish final system baseline and meet projected system reliability and maintainability goals.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

Budget Activity: 4, Tactical Programs
Program Element: 64362F, Ground Launched Cruise Missile (GLCM)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Ground Launched Cruise Missile (GLCM) test program is being managed by the Joint Cruise Missiles Project Office (JCMPO). General Dynamics is the integrating contractor, and the Air Force Flight Test Center is the development test agency. GLCM development testing of the TOMAHAWK missile incorporated test results from the Sea Launched and Air Launched Cruise Missile programs to reduce GLCM test requirements. Applicable areas included engine performance qualifications, airframe, navigator/guidance, and missile performance.

(U) The first of three contractor test launches was a TOMAHAWK missile from an engineering test unit of the Transporter Erector Launcher (TEL) on 16 May 1980 at Dugway Proving Ground, Utah and was a partial success. This test was recovered early due to an oil leak. The other two contractor test flights were successful.

(U) The seventh and last Development Test and Evaluation (DT&E)/Initial Operational Test and Evaluation (IOT&E) flight test was completed on 27 July 1983. All DT&E/IOT&E flights were successful except for a guidance problem due to a loose screw which curtailed the 27 August 1982 mission and a pneumatic pressure system problem which prevented air inlet deployment and start of the cruise engine on the 17 December 1982 mission. Corrective actions implemented for flight test anomalies have prevented recurrence.

(U) The DT&E program provided data in the areas of flight test, environmental test, and operations and maintenance demonstrations.

(U) The flight test program provided W84 warhead flight test data to the Department of Energy, investigated launch environment effects on the TEL, and provided data to evaluate system performance for compliance with the system specification.

(U) Environmental tests demonstrated the adequacy of the GLCM system to function through its expected range of environments.

(U) The operations and maintenance demonstrations focused on maintenance of the GLCM ground systems since the GLCM maintenance concept provides for only limited maintenance on the missile.

(U) The primary test site was the Utah Test and Training Range with tests also conducted at Aberdeen Proving Ground, MD, and Eglin Air Force Base, FL. Tests were conducted using a total of three Launch Control Centers, four

Budget Activity: 4, Tactical Programs
Program Element: 64362F, Ground Launched Cruise Missile (GLCM)

Transporter Erector Launchers, nine missiles and related support equipment. Recovery and refurbishment of flight tested missiles enabled multiple test launches of individual missiles.

(U) An Extended Storage Program (ESP) during Development Test and Evaluation (DT&E)/Initial Operational Test and Evaluation (IOT&E) used three missiles to help assess Ground Launched Cruise Missile (GLCM) system storage reliability.

(U) Chemical testing on the Launch Control Center was conducted between August 1983 and October 1983.

(U) Missile qualification to GLCM environment was successfully conducted in November 1983.

(U) Corrections to deficiencies identified during DT&E are being implemented.

(U) The GLCM weapon system is scheduled for Electromagnetic Pulse (EMP) testing in 1985.

2. (U) Operational Test and Evaluation (OT&E): The overall objective of OT&E is to provide a valid estimate of the operational effectiveness and suitability of the GLCM weapon system, to identify operational deficiencies and to identify the need for any modifications. The Air Force Operational Test and Evaluation Center (AFOTEC) is the OT&E Command. The Tactical Air Command (TAC), US Air Forces Europe (USAFE), Air Training Command (ATC), Air Force Logistics Command (AFLC), and Military Airlift Command (MAC) are participating commands. Personnel from US European Command (EUCOM) are participating in OT&E of the Mission Planning Subsystem.

(U) The principal flight test location for GLCM OT&E is the Utah Test and Training Range (UTTR), Utah. All test air vehicles will have telemetry packages and remote control systems installed.

(U) Initial Operational Test and Evaluation (IOT&E) of GLCM was conducted by AFOTEC to provide an initial estimate of operational effectiveness and suitability of the weapon system.

(1) (U) OT&E of the GLCM weapon system officially started on 19 May 1982 with the successful launch of the first DT&E/IOT&E flight test. The seventh and final DT&E/IOT&E flight test was launched on 27 July 1983. This missile launch and flight resulted in no identifiable deficiencies. All test objectives were met.

(2) (U) A Dispersal Evaluation exercise was conducted at McChord AFB/Ft Lewis, Washington, during January 1983. A GLCM flight consisting of two Launch Control Centers and four Transporter Erector Launchers, security forces, and supply/support vehicles moved from Dugway Proving Ground, Utah, to McChord AFB, Washington, in convoy. At Ft Lewis, the dispersed GLCM flight was evaluated under realistic wartime environment and threat conditions.

Specific areas of evaluation included operational concepts and procedures, preflight detectability and survivability, deployment and relocation, maintenance concept, resupply, communications, human factors, and operational timelines. The exercise was successful even though some problems in the areas of power generation, communications security, and human factors were highlighted.

(3) (U) The Initial Operational Test and Evaluation (IOT&E) final report was published in February 1984.

(U) Follow-on Operational Test and Evaluation (FOT&E) Phase I was conducted by Air Force Operational Test and Evaluation Center to complete evaluations not finished during IOT&E, to refine IOT&E estimates, evaluate changes and modifications to correct previously identified deficiencies, and to identify additional deficiencies.

(1) (U) FOT&E Phase I started on 1 June 1983 and was completed on 30 June 1984. Those aspects of Sea Launched Cruise Missile (SLCM) and Air Launched Cruise Missile (ALCM) mission reliability, performance and survivability testing which reflect GLCM operational requirements were used in conjunction with formal GLCM Operational Test and Evaluation (OT&E) test data. On 19 November 1983, the first FOT&E Phase I flight test impacted the ground after 19 minutes of flight. Cause of the failure was determined to be a missile generator failure. The remaining two FOT&E Phase I flights were successfully completed in April 1984.

(2) (U) The complete GLCM weapon system was not available for evaluation at the start of FOT&E Phase I. Technical data and support equipment deliveries were time-phased. Depot level and centralized maintenance facility equipment and technical data will not be available until 1986. Contractor support is being employed at depot level. Service personnel, representative of operational personnel, operated and maintained the weapon system to the extent possible during FOT&E Phase I. Because of technical data and support equipment sharing, contractor personnel performed maintenance on some parts of the weapon system during FOT&E Phase I. A system approach to the evaluation of availability, reliability (both mission and logistics), and maintainability was a major operational suitability test objective. Quantitative (critical, high interest, and desirable maintenance and operational demonstrations performed by Air Force personnel) and qualitative maintainability evaluations were accomplished. Mature system evaluation criteria (thresholds) are being established for significant areas of evaluation. The System Effectiveness Data System (SEDS) was used to collect and analyze reliability and maintainability test data. Service reports were submitted IAW Section V, Technical Order 00-35D-54 (USAF Material Deficiency Reporting and Investigating System).

(3) (U) The FOT&E Phase I final report was published in August 1984. The report stated that the weapon system can perform its mission. However, management attention is required in the areas of power generation, system software, technical orders, trainers and human factors. These areas are and will continue to receive management attention. Communications were evaluated in a benign environment due to test limitations and was not rated. The Regency communications update within the Theater is scheduled which will improve communication in a jamming environment.

Budget Activity: 4, Tactical Programs
Program Element: 64362F, Ground Launched Cruise Missile (GLCM)

(U) Follow-on Operational Test and Evaluation (FOT&E) Phase II analysis began in July 1984 and will end in December 1985. The purpose of FOT&E Phase II is to ensure that the system can meet changing operational requirements; support Department of Energy (DOE) warhead testing; comply with requirements of Weapon System Evaluation Group 92 (WSEG-92) directives; identify operational deficiencies and confirm that previously identified deficiencies have been corrected; and provide for a continuing analysis of operational effectiveness and suitability. The United States Air Force Tactical Air Warfare Center (USAFTAWC) will conduct the Tactical Air Command (TAC) operational test program. The test team will be based at Davis-Monthan AFB, AZ, with operating locations at Hill AFB, UT, and Dugway Proving Ground, UT. United States Air Forces Europe (USAFE) and USAFTAWC will establish theater ground system and Command Control Communications data collection programs and forward data to USAFTAWC, Detachment 2 for assessment.

(U) Phase II will consist of Continental United States (CONUS) flight tests and ground tests conducted in both the CONUS and at operational bases. Thirteen flight tests are scheduled. The missiles will be refurbished and returned to the operational inventory. The first FOT&E Phase II flight test failed 22 seconds after launch on 18 September 1984. The missile did not transition to cruise flight. The second FOT&E Phase II flight test is planned for late 1984. In addition to flight tests, ground tests will be used to evaluate equipment modifications and to develop and/or improve operational procedures.

(U) GLCM System Evaluation Program (GSEP), a life cycle test-program, will be conducted by USAFTAWC and USAFE after the completion of the GLCM FOT&E Phase II. USAFTAWC and USAFE will comply with applicable Air Force directives and the anticipated Joint Chiefs of Staff (JCS) reporting requirements by establishing an evaluation program designed to determine changes in reliability and accuracy that may occur with the passage of time. The GSEP will begin in January 1986 and continue through the life of the weapon system.

(U) USAFTAWC, under the direction of TAC, will conduct a 12 launch per year flight test program. As in FOT&E Phase II, missiles will be selected from the field and/or production line in a way that will provide an age/model mix that represents the deployed force. Additionally, combat ready launch crews, maintenance and security police personnel from the deployed Main Operating Bases (MOBs) will be required to conduct the test launches.

3. System Characteristics:

Physical Characteristic

TOMAHAWK (BGM-109G)	
Length (without booster)	219 inches
Weight	2700 lbs
Warhead (W84)	

Budget Activity: 4, Tactical Programs
Program Element: 64362F, Ground Launched Cruise Missile (GLCM)

Transporter Erector Launcher (TEL) towed by 10 ton M.A.N. Tractor	
Number of missiles per TEL	4
Approximate TEL weight including tractor	78,000 lbs
Launch Control Center (LCC) towed by 10 ton M.A.N. Tractor	
Number of TELs controlled by LCC	4
Approximate LCC weight	79,000 lbs

Development Test & Evaluation/Initial Operational Test & Evaluation Flights

Contractor flights completed	3
Air Force flights completed	7
TOTAL	10

Follow-on Operational Test and Evaluation Flights

	Planned	Completed
Phase I (June 1983 - June 1984)	3	3
Phase II (July 1984 - December 1985)	13	1
GLCM Systems Evaluation Program (GSEP)	12/year	0

Missile Performance

	Goal	Mature Threshold*	Current Estimate**
Speed (Mach)	—		
Max Penetration			
Cruise	—		—
Range (Kilometers)	2500	2500	2500
Penetration Altitude, Smooth Terrain (Feet, above ground level)			

Budget Activity: 4, Tactical Programs
Program Element: 64362F, Ground Launched Cruise Missile (GLCM)

Misisle Performance (Continued)

	Goal	Mature Threshold*	Current Estimate**
Circular Error Probability (Feet)			
Availability	.95	N/A***	.93
System Reliability	.85	N/A***	.79
Mission Reliability	.80	.80	.74****

* Mature threshold is applicable at Full Operational Capability in FY 1988.

** Current estimate is based on test data or analysis.

*** Mission reliability is the product of availability times system reliability. Availability and system reliability do not have to meet a specific threshold as long as this product meets the mission reliability threshold.

**** Based on data through June 1984, the current estimate for mission reliability exceeds the .73 interim threshold. The estimate of mission reliability at maturity in FY

Budget Activity: 4, Tactical Programs
Program Element: 64362F, Ground Launched Cruise Missile (GLCM)

4. (U) Current Test and Evaluation (T&E):

Event	T&E Activity (Past 12 Months) Actual Date	Remarks
Weapon Control System Maintainability Demonstrations	January 1984	Successful
Missile Procedures Trainer Evaluation	January-May 1984	Successful
Communications Testing	April-May 1984	Successful
FOT&E Phase I Flight Test #2	3 April 1984	Successful
FOT&E Phase I Flight Test #3	5 April 1984	Successful
FOT&E Phase II Flight Test #1	18 September 1984	Failure (inlet scoop actuator)
FOT&E Phase II Flight Test #2	14 December 1984	Successful

Event	T&E Activity (Next 12 Months) Planned Date
FOT&E Phase II Flight Test #3 - #13	January 1985 - December 1985
Weapon System Electromagnetic Pulse (EMP) Testing	February 1985

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64601F
DOD Mission Area: 276 - Defensive Chemical and Biological Systems

Title: Chemical/Biological Defense Equipment
Budget Activity: 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		20,092	18,221	22,488	34,795	Continuing	N/A
3321	Chemical and Biological Agent Detection & Warning	2,886	1,800	3,350	10,966	Continuing	N/A
3337	Individual Protection	7,245	10,500	12,348	13,022	Continuing	N/A
3762	Collective Protection	8,444	2,900	4,786	6,462	Continuing	N/A
3764	Decontamination	613	1,321	2,004	4,345	Continuing	N/A
5271	Bigeye	904	1,700	0	0	0	5,900

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element includes Research, Development, Test and Evaluation of systems to detect, warn against, protect and decontaminate personnel and equipment from chemical/biological agents. These systems will allow the Air Force to continue its mission in a chemical/biological environment. Without these protective systems sortie generation may be significantly degraded. Also includes integration of Bigeye binary munition with Air Force fighter aircraft.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	15,415	18,222	13,193		Continuing	N/A
Other Procurement (PE 27593F)	12,800	59,319	249,100		771,700	871,418
Operations & Maintenance (PE 27593F)	14,100	16,000	60,000		331,000	421,100

Increase in FY 1984 RDT&E funds is for additional full-scale development (FSD) of the Impermeable Chemical Defense Suit, purchase of Survivable Collective Protection Systems for exercise Salty Demo scheduled for Spring 1985 and, increased FSD of Bigeye. Increase in FY 1986 RDT&E funds is for FSD of Chemical Defense Body Cooling devices, Transportable Collective Protection shelters, decontamination systems for equipment avionics and aircraft interiors, and in cooperation with the Army in developing an Area Detection System and a Filter Life Indicator. Reductions in procurement funds in FY 1985 and FY 1986 and in operations and maintenance funds in FY 1986 were made to fund higher priority Air Force efforts.

4. (U) OTHER APPROPRIATION FUNDS: Source of funds PE 27593F, Chemical Warfare Defense Equipment

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
3321 Chemical and Biological Agent Detection and Warning						
Funds	0	1,000	9,486	19,895	Continuing	N/A
Quantities*						
3337 Individual Protection						
Funds	4,539	15,000	7,163	36,510	Continuing	N/A
Quantities*						
3762 Collective Protection						
Funds	0	18,441	64,584	105,253	Continuing	N/A
Quantities*						
3764 Decontamination						
Funds	5,261	3,422	0	0	Continuing	N/A
Quantities	(392)	(250)				
Operations and Maintenance:						
3337 Individual Protection						
Funds	11,000	16,194	37,602	51,283	Continuing	N/A
Quantities*						

*Varying quantities of different types of equipment.

5. (U) RELATED ACTIVITIES: The related Air Force programs are: PE 27593F, Chemical Warfare Defense Equipment; PE 62202F, Aerospace Biotechnology; PE 63745F, Chemical Warfare Defense; PE 64617F, Air Base Survivability; and PE 64703F, Aeromedical Chemical Defense Systems Development. Tasks are coordinated with other services in accordance with Joint Service Agreement on Chemical Warfare and Chemical-Biological Defense Requirements, Research, Development,

and Acquisition of 5 July 1985. The related Army programs are: PE 62706A, Chemical/Biological Defense and General Investigation; PE 63721A, Chemical Defense Concepts; PE 64724A, Biological Defense Material; and PE 64725A, Chemical Defense Material. The related Navy programs are: PE 62764N, Chemical/Biological/Radiological Defense Technology; PE 64506N, Chemical/Biological/Radiological Warfare Countermeasures.

6. (U) WORK PERFORMED BY: The top five contractors ($25,000 or more) are: (1) Systems Research Laboratory, Dayton, OH, (Project 3762, Collective Protection); (2) Honeywell, Clearwater, FL, (Project 3321, Chemical and Biological Agent Detection and Warning); (3) Geomet, Rockville, MD, (Project 3337, Individual Protection); (4) Rohm and Haas, Philadelphia, PA, (Project 3337, Individual Protection); (5) Gentex, Carbondale, PA, (Project 3337, Individual Protection). There are five additional contractors and the total dollar value of the additional contracts is $600,000. The in-house developing organization for Projects 3321, 3337, 3762 and 3764 is Air Force Systems Command's Aeronautical Systems Division, Life Support Systems Program Office, Wright-Patterson AFB, OH.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3321, Chemical and Biological Agent Detection and Warning. The purpose of this project is to develop a capability to automatically detect and warn against chemical and biological agents and indicate the degree and location of contamination so that corrective action can be taken. This capability will allow personnel the opportunity to don/doff protective ensembles and enter/exit collective protection systems when under chemical or biological attack. Project accomplishments in FY 1984: (1) performed critical review of the Area Detection System (ADS), (2) redesigned and performed Developmental Test and Evaluation (DT&E) of the Surface Contamination Monitor (SCM), (3) initiated Operational Test and Evaluation (OT&E) of the Automatic Liquid Agent Detector (ALAD), and (4) continued development of an Integrated Chemical Detection and Warning System (ICDWS). Plans for FY 1985 are to complete development of ALAD, complete OT&E of the SCM, continue development of the ICDWS, and work with the Army to develop the ADS. The FY 1986 program will complete development of SCM, continue development of ICDWS, continue to work with the Army to develop ADS, and initiate work with the Army to develop a Filter Life Indicator.

B. (U) Project: 3762, Collective Protection. The purpose of this project is to develop collective protection systems that provide group rest and relief, and allow selective mission performance during a chemical/biological attack. Current individual protective equipment does not allow personnel to eat or eliminate waste in a toxic environment. Also, individual protection ensembles must be changed within six hours of direct liquid agent contamination. Accomplishments during FY 1984 were completion of DT&E and OT&E of the Air Force designed Survivable Collective Protection System. Plans for FY 1985 are to develop a set of Transportable Collective Protection Shelters, initiate preplanned product improvement of the Survivable Collective Protection System (SCPS-2), and evaluate alternative designs for Survivable Collective Protection Systems. The FY 1986 program will continue development of a set of Mobile Collective Protection Shelters, and preplanned product improvement of the SCPS-2 and evaluation of alternate designs for SCPS-2.

C. (U) Project: 3764, Decontamination. The purpose of this project is to develop materials, methods, and equipment for removing or neutralizing chemical warfare agents from personnel, vehicles, aircraft, equipment and facilities without adverse effects on mission performance. Decontamination is required so personnel can work safely after a chemical or biological attack. Standard decontaminants are very corrosive to aircraft interior and avionics materials. Special chemical decontaminants and/or innovative decontamination methods must be developed and tested. Plans for FY 1985 are to initiate Full-Scale Development (FSD) of systems to decontaminate avionics equipment and aircraft interiors. Plans for FY 1986 are to continue development of these systems.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3337, Individual Protection

A. (U) Project Description: Project will develop protective ensembles and equipment systems for aircrew, groundcrew, and special team personnel. The purpose of these systems is to protect personnel from effects of chemical or biological agents while still allowing personnel to perform their missions. Work being done under this project includes development of aircrew protective chemical masks in the Aircrew Chemical Defense Eye/Respiratory Protection (AERP) Program (a combined program to continue previous efforts of the Integrated Chemical Defense System (ICDS) and the Chemical Defense Multi-purpose Mask), improved Chemical Defense Ensembles, Chemical Defense Body Cooling Devices, and an Impermeable Suit (Imp Suit).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Selected candidate fabrics for follow-on development of aircrew and Chemical Defense (CD) Ensembles. Initiated development of second generation ensemble for aircrews. Performed Development Test and Evaluation (DT&E) of ICDS and Imp Suit. Initiated plan for test and evaluation of the United Kingdom's Aircrew Respirator number 5 (AR-5).

(2) (U) FY 1985 Program: Perform DT&E of aircrew ensembles. ICDS was terminated due to incompatibility with the ACES II ejection seat. In Phase I of the AERP program, review aircrew eye/respiratory requirements for all USAF aircraft, analyze current equipment and technologies, and match equipment/aircraft requirements. Continue test and evaluation of AR-5 aircrew mask to determine its applicability to the AERP Program. Continue development of the Imp Suit, including interface with body cooling subsystems.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Complete evaluation of AR-5. Continue to Phase II of the AERP Program on a competitive basis selecting for development the systems as determined in Phase I. Continue development of improved aircrew Chemical Defense ensembles and Impermeable Suit. Initiate Full Scale Development of body cooling equipment.

C. (U) Major Milestones:

Milestones	Dates
Aircrew Eye/Respiratory Protection (AERP)	
(1) (U) Initiate Phase I	2Q FY 1985
(2) (U) Complete Phase I	1Q FY 1986
(3) (U) Initiate Phase II	2Q FY 1986
(4) (U) First Production Decision	2Q FY 1987
(5) (U) Complete Phase II	3Q FY 1987

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64602F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Armament/Ordnance Development
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		18,424	18,764	17,563	24,339	Continuing	N/A
2586	Dispenser Munitions	708	1,500	2,980	11,000	Continuing	N/A
2708	Aircraft Gun Systems	1,502	102	0	0	Continuing	N/A
2784	Armament Control Focal Point	1,056	1,692	1,467	2,550	Continuing	N/A
3113	HAVE VOID/I-2000*	4,395	9,045	10,817	2,500	0	30,756
3133	Bombs and Fuzes	5,316	5,649	2,299	5,820	Continuing	N/A
5613	Carriage, Release and Handling Equipment/Containers	5,447	776	0	2,469	Continuing	N/A

*Previously in Project 3133

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element is the primary source for modernizing and developing unguided air-to-surface conventional munitions and associated equipment. The program supports numerous Statements of Need such as Strategic Air Command 26-82, 07-82; and Tactical Air Forces 314-80, 310-82, 306-79. There are two categories of efforts: those to provide new capabilities to fill operational voids, and those to eliminate deficiencies in current capabilities by modernizing existing munitions and equipment. Efforts also include formal standardization of munitions and associated equipment. Activities involve the engineering design, development, test and evaluation of a variety of improved conventional weapons and munitions handling equipment. The program includes: bombs and hardened target warheads; unguided dispenser munitions; bomb fuzes and proximity sensors; munitions handling equipment and containers; antiarmor gun pod; weapons carriage and release equipment.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	20,660	20,764	21,849		Continuing	N/A
Aircraft Procurement (PE 52610F) Project #2708, Gun Pod	27,900	0	0		Continuing	N/A

Program Element: #64602F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Armament/Ordnance Development
Budget Activity: #4 - Tactical Programs

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement (PE 27133F)						
Project #5613, Multiple Stores Ejector Rack	28,200	71,900	94,400		Continuing	N/A
Other Procurement (PE 28030F)						
Project #2586, Combined Effects Munition (CEM)	86,519	281,897	620,250		Continuing	N/A
Project #3133*	27,910	42,745	83,266		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
Project #2708, Gun Pod						
Funds (PE 52610F)	29,600	0	0	0	0	104,939
Quantities	(80)					
Project #5613, Manually Operated Lift Trailer						
Funds (PE 28031F)	0	0	9,400	20,100	Continuing	N/A
Quantities			(428)	(902)		
Missile Procurement						
Project #5613, One Step Loading Adapter						
Funds (PE 28031F)	0	639	0	0	Continuing	N/A
Quantities		(200)				
Other Procurement (PE 28030F)						
Project #2586, CEM						
Funds	86,519	281,927	543,120	579,784	Continuing	N/A
Quantities	(1,380)	(8,500)	(22,500)	(29,215)		
Project #3113						
Funds	0	3,750	11,836	32,937	Continuing	N/A
Quantities		(300)	(1000)	(2000)		
Project #3133*	27,910	42,745	72,115	111,397	Continuing	N/A
Project #5613*	0	3,298	4,016	3,129	Continuing	N/A

*Numerous items under project numbers 3133 and 5613 are funded under PE #28030F.

5. (U) RELATED ACTIVITIES: Submunitions such as the BLU-106/B Bomb, Kinetic Energy Penetrator (BKEP) being developed in Program Element 64604F, Submunitions Development, are selected for weaponization into unguided dispensers under this program element. Items from the advanced development program, Program Element 63601F, Conventional Weapons, such as the Improved 2000 Pound (I-2000) Warhead, are selected for continuation into Full Scale Development (FSD) under this program element. FMU-139 fuze, under project number 3133, is a joint US Navy and US Air Force program. Close liaison is maintained between the services through the Joint Technical Coordinating Group for Munitions Development and through coordination with the Department of Defense Armaments/Munitions Requirements and Development Committee.

6. (U) WORK PERFORMED BY: This program is managed by the Armament Division at Eglin AFB, FL. The major contractors are Lockheed Missiles and Space Company, Inc, Sunnyvale, CA, (Project 3113); Dayron Corporation, Orlando, FL, (Project 3133); Motorola Corporation, Scottsdale, AZ, (Projects 2586 and 3133); General Electric Company, Burlington, VT, (Project 2708); Western Gear Corporation, Jamestown, ND, (Project 5613). There are five additional contractors with contracts totalling $3.67 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2586, Dispenser Munitions. This project develops cost-effective dispenser munitions and improves existing dispenser systems. HAVE MAIL is a current program to improve the Tactical Munitions Dispenser (TMD). In FY 1984, HAVE MAIL contracts were awarded to evaluate candidate modifications to the TMD. Test and evaluation of these modifications provided data for a tradeoff analysis of performance versus cost of candidate modifications. In FY 1985, a HAVE MAIL test design will be selected and efforts will be started to qualify the design. This includes fabrication of test units and beginning the test program. In FY 1986, HAVE MAIL qualification testing of the modified TMD will be completed. The Direct Airfield Attack Combined Munition (DAACM) program is to weaponize eight BLU-106/Bs and 24 British HB-876 mines into a TMD. DAACM will significantly improve airfield attack capability with multiple cratering of runway and taxiway surfaces. The mines are dispensed with BKEPs to impede repair operations as well as to threaten aircraft. Source selection for DAACM FSD will be in FY 1985, and HB-876 mine will be modified to make it compatible with DAACM. FSD will then begin in FY 1986.

B. (U) Project: 2784, Armament Control Focal Point. This project increases standardization and commonality in armament subsystems. The goal is to reduce proliferation and take maximum advantage of prior investments. A data retrieval system is maintained to ensure maximum use of existing containers, munitions handling equipment and other related items. In FY 1985, an Office for Armament Control will be established. An annual armament planning conference will be started during FY 1986, as well as activities to enhance standardization of armament/aircraft interfaces. In FY 1987 these efforts will be expanded to include stores suspension equipment, conformal weapon handling equipment, advanced aircraft-to-armament system interface technical data and munitions/armament application of standard high order languages.

C. (U) Project: 3133, Bombs and Fuzes. This project develops and improves bombs and fuzes. In FY 1984, the FMU-139 electronic bomb fuze was approved for production by the Navy; Air Force completed development of the FZU-48/B power supply for the FMU-139; Development Test and Evaluation (DT&E) of the FMU-130/B impact mechanical fuze (low drag) was also completed. Early separation and compatability testing of the Timer Actuator, Fin and Fuze (TAFF) for the B-1/B-52 began on the B-1. TAFF is a timing device which delays the fin/retarder actuator on high drag general purpose bombs until the munition is clear of the delivery aircraft. It is compatible for internal bomb bay carriage on the B-52 and B-1B aircraft. In FY 1985, Initial Operational Test and Evaluation (IOT&E) of the FMU-139 and FMU-130/B (low drag) fuzes will be completed and production decisions will be made. The high drag sensor for the FMU-130/B dual mode (high-low drag) will be tested and a decision will be made on whether to build these fuzes for DT&E/IOT&E. IOT&E for the TAFF will be completed, to be followed by a production decision in FY 1986. Development of a proximity sensor (DSU-xx) for general purpose bombs begin in FY 1985. The program repackages the proximity sensor portion of the existing FMU-113 fuze to allow compatibility with FMU-112 and FMU-139 fuzes. This will allow bombs using these fuzes to be detonated above the ground for better effectiveness against many targets. In FY 1986, testing of the proximity sensor will be completed and a production decision will be made.

D. (U) Project: 5613, Carriage, Release and Handling Equipment and Containers. This project develops more capable bomb racks, ejectors and associated handling/release equipment, and improves munitions material handling equipment and containers. In FY 1984, development and test effort for the four-station version of the Multiple Stores Ejector Rack (MSER-4) was terminated, and a reprocurement data package was procured. In FY 1985, flight testing on the two-station version, MSER-2 (BRU-39/A), will be completed. DT&E/IOT&E of the Rapid Assembly Munition System (RAMS) will be completed, and a production decision will be made in late FY 1985. RAMS uses an assembly line with conveyor belts and work stations to rapidly assemble munitions and preload the munitions onto bomb racks. Development of a Simplified Munitions Lift Trailer (SMLT) is being planned for use with the B-52 and B-1B. In FY 1986, the Transportable Missile Storage Rack (TMSR) Request for Proposal will be prepared and released, and a contractor will be selected for the effort which will begin in FY 1987. The TMSR will provide for high density storage and intra-theater air transportation of missiles.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3113, HAVE VOID/I-2000 Warhead

A. (U) Project Description: This project develops weapons which provide hardened targets penetration capability. HAVE VOID is a Quick Reaction Capability (QRC) program to provide a near-term capability by developing and interfacing a penetrating warhead with GBU-10 and demonstrating compatibility with the F-4E aircraft. The Improved 2000 Pound (I-2000) Warhead program, previously under Project 3133, is a pre-planned product improvement program to expand that capability by developing GBU-15 and GBU-24 interfaces, improving the fuze, and demonstrating compatibility on additional aircraft.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: HAVE VOID Full Scale Development (FSD) began, and Critical Design Review was conducted. Planning for FSD of I-2000 began.

(2) (U) FY 1985 Program: HAVE VOID Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) will be completed, and a production decision will be made for the first 300 weapons. I-2000 will transition from PE 63601F, Conventional Weapons Technology, to begin FSD. Analysis will be done to determine desirability of developing an unguided high drag/low drag variant of I-2000 to complement the MK-84 inventory as a general purpose bomb.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: HAVE VOID production decision will be made for the final 1000 weapons, and production deliveries will be completed. FSD of I-2000 will be continued. Efforts will include interfacing I-2000 to GBU-15 and GBU-24, demonstrating compatibility with F-4, F-16, F-15, F-111 and A-7, and improving the fuze. Production decision is expected in FY 1986. The cost estimate, updated in Sep 84, is considered Category IV, Planning.

(4) (U) Program to Completion: Not Applicable

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	I-2000 Contract Award	March 1985
(2)	(U)	HAVE VOID DT&E/IOT&E Complete	July 1985
(3)	(U)	HAVE VOID Production Decision	November 1985
(4)	(U)	I-2000 DT&E/IOT&E Complete	June 1986
(5)	(U)	I-2000 Production Decision	August 1986

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64604F Title: Submunitions
DOD Mission Area: #223 - Close Air Support and Interdiction Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	18,070*	36,322	43,910	13,217	Continuing	TBD
3051	Boosted Kinetic Energy Penetrator (BKEP)	7,500*	11,602	14,758	0	0	37,760
3086	Skeet Submunition	10,570*	17,801	14,464	0	0	43,935
3088	Extended Range Antiarmor Munition (ERAM)	0	1,919	1,100	8,500	2,500	14,019
3089	Terminally Guided Submissile (TGSM)/Sense and Destroy Armor (SADARM) Evaluation	0	5,000	13,588	4,717	4,843	28,148
3166	Submunition Development	0	0	0	0	38,004	38,004

*In FY 1984 Submunitions funding was contained in PE 64607F for one year only.

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops a family of conventional submunitions. The Tactical Air Forces (TAF) require a munition to reduce enemy sortie generation capabilities. The BKEP submunition is being developed to provide this capability by cratering runway and taxiway surfaces. Due to the large numerical imbalance of Warsaw Pact armored forces, the TAF require a munition that will provide multiple kills per pass in day, night, and adverse weather. The Skeet and ERAM submunitions are being developed to provide this capability. The US Army's TGSM/SADARM munitions are being evaluated[ ] should Skeet and ERAM fail to provide the expected performance. This effort has been expanded to determine[ ] The Hypervelocity Submunition development was moved to PE 63363F Hypervelocity Missile (HVM). The CEB/SUU-54 effort in support of the product improvement to the GBU-15 has been cancelled to accelerate the higher priority BKEP integration into the SUU-54 and SUU-64 dispensers. This effort

develops the dispenser, the ejection subsystem, and integration of Boosted Kinetic Energy Penetrator (BKEP) submunitions into the SUU-54 and SUU-64 dispensers for runway attack. Submunition development provides for continued future development of submunitions.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	18,600	48,677	38,776		Continuing	N/A

(U) In FY 1985 Congress cut funding for the Skeet and Hypervelocity Submunition.
(U) FY 1986 includes funds to initiate full scale development of the Extended Range Antiarmor Munition (ERAM).

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The integration of the Skeet submunition into the tactical munitions dispenser (TMD) to develop the Sensor Fuzed Weapon (SFW) is funded under PE 64607F, Wide Area Antiarmor Munitions. Similarly, the ERAM submunition will be integrated with the TMD under PE 64607F. Test efforts for the BKEP in specific carriers will be funded under program elements for each carrier vehicle used. Candidate dispenser vehicles are currently under study, including the TMD for direct over-flight attack, PE 64602, and the AGM-130, PE 64733, for medium-range standoff attack. Prior to creation of this program element, funding for BKEP was under PE 64614F, Medium Range Air-to-Surface Missile (MRASM). Prior to FY 1985, evaluation of the Terminally Guided Submissile (TGSM) was included in the US Army PE 63303A, Surface-to-Surface Missile Rocket System. Sense and Destroy Armor Munition (SADARM) development effort is conducted under Army PE 63628A, Field Artillery Ammunition Development, and PE 64631A, Field Artillery Ammunition. Integration of the Hypervelocity Submunition into the Hypervelocity Missile (HVM) system is included in PE 63363F, Hypervelocity Missile System. Submunition Development, PE 64604F, precludes duplication of efforts between separate dispenser vehicle programs.

6. (U) WORK PERFORMED BY: Program management is provided by Headquarters Air Force Systems Command, Andrews Air Force Base, MD, and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Contractor support for BKEP, SKEET, and ERAM submunitions is provided by AVCO Corporation, Wilmington, MA. Contractor support for the TGSM is provided by General Dynamics Corporation, Pomona, CA. Contractor support for the SADARM program is provided by Aerojet Corporation, Downey, CA; Honeywell Inc, Hopkins, MN; and AVCO Corporation, Wilmington, MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3088, Extended Range Antiarmor Munition (ERAM). The ERAM is a 1000 pound munition consisting of the tactical munitions dispenser (TMD) packaged with nine submunitions. Each submunition is an acoustically and seismically activated mine which ejects a warhead with an integral infrared sensor to attack valid targets from the top. The ERAM will provide delay, disruption and multiple kills of enemy armor. This project provides for full scale development of the submunition, while the integration into the TMD and systems test effort is conducted under PE 64607F, Wide Area Antiarmor Munition. The program cost was estimated using both parametric and engineering buildup (grassroots) estimating techniques. In FY 1984 ERAM continued validation and all-up hand placed submunitions tests. The FY 1985 effort will concentrate on further development of both the seismic and acoustic ground sensors snd skeet infrared sensor considered the higher risk items of the program. Full scale development will begin in late FY 1986 to integrate the submunition into the tactical munition dispenser. Qualification, flight test and DT&E/IOT&E will continue through FY 1989 when production is planned.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3089, Terminally Guided Submissile (TGSM)/Sense and Destroy Armor (SADARM) Evaluation

A. Project Description: TGSM and SADARM are US Army development efforts. TGSM was a submunition candidate for the Assault Breaker program. SADARM is an artillery-fired antiarmor weapon with smart sensors to improve the probability of a hit. These submunitions will be evaluated [ ] This evaluation will include some submunition testing and is intended to provide backup candidates should technical, cost, or schedule problems prevent successful development of Skeet submunition. [ ] Phase I will consist of studies, analysis, and warhead testing. Phase II, should it be warranted, will flight demonstrate a promising weaponization concept defined in Phase I.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: In FY 1984, program documentation, required procurement documents, statement of work, and request for proposal for Phase I were completed.

(2) FY 1985 Program: In FY 1985 contracts will be awarded for analysis and testing of the TGSM, SADARM, and Skeet submunitions.

Flight demonstration hardware will be conceptually defined.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In FY 1986 the warhead effectiveness testing will continue and the most promising weaponization concept of either Terminally Guided Submissile (TGSM) or Sensor and Destroy Armor (SADARM) is planned to be flight demonstrated.

(4) Program to Completion: Continued evaluation of additional targets, is planned to determine submunition effectiveness

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3051, Boosted Kinetic Energy Penetrator (BKEP)

A. (U) Project Description: This project develops and qualifies the BKEP submunition for runway and taxiway cratering capability. Its development will be accelerated to provide a standoff runway attack capability for the AGM-130 and the Direct Airfield Attack Combined Munition (DAACM). The BKEP is a 45 pound submunition which is rocket-boosted to penetrate through concrete runway surfaces. The warhead then detonates beneath the surface to cause heave damage as well as cratering. Once qualified, BKEP will be weaponized in conjunction with separate dispenser program element(s). In FY 1983, full scale development was begun in support of the Medium Range Air-to-Surface Missile (MRASM). Components were developed, and prequalification component testing of the fuze and rocket motor was begun. When Congress terminated MRASM, BKEP development was moved to SubmunitionsDevelopment (PE 64604F) and a study to evaluate candidate dispenser(s) was started. Weaponization efforts on selected dispenser(s) will be paced by dispenser development schedules. The program cost was estimated using engineering buildup (grassroots) estimating techniques.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Qualification of the fuze, rocket motor, and other components was completed. Studies were completed to select suitable dispenser(s).

(2) (U) FY 1985 Program: Flight qualification with delivery test from a dispenser is planned. Weaponization design efforts on selected dispenser(s) will begin.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In FY 1986 full scale development will be initiated to integrate the BKEP into the SUU-54 and SUU-64 dispensers for runway attack. Testing of the dispensing subsystems is planned for late FY 1986.

(4) (U) Program to Completion: After FY 1986 funding will continue in PE 64733F with qualification testing, Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) and production in FY 1988.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Full Scale Development Start	March 1983
(2) (U) Submunition Critical Design	*March 1985
(3) (U) Full Scale Development/Integration into the AGM-130 and Direct Airfield Attack Combined Munition (DAACM)	FY 1986

*Milestones not presented in FY 1985 Descriptive Summary.

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3086, Skeet Submunition

A. (U) Project Description: This project provides for the full scale development of the Skeet submunition. Ten Skeet submunitions are packaged in the Tactical Munitions Dispenser (TMD) to comprise the Sensor Fuzed Weapon (SFW). Each submunition contains four Skeet warheads with an integral infrared detector for warhead initiation. The TMD is dropped from low altitude, the ten Skeet submunitions are dispensed and fall on parachutes. At a predetermined height a rocket motor pushes the submunition back up. The four Skeet warheads are then thrown out and scan the ground for targets. When they detect a target with their IR sensor a self-forging slug is fired into the target. SFW will provide a multiple kill per pass capability during day/night and limited adverse weather conditions. Skeet may also be packaged in other carrier vehicles such as GBU-15.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The demonstration program with full function testing of the Skeet in the Skeet Delivery Vehicle was completed. Testing was encouraging enough to continue with a two phased program in FY 1984 to reduce risk. Phase I to demonstrate successful dispensing of the Skeet Delivery Vehicle and additional full function testing was initiated in FY 1984. Flight testing of the Skeet sensor was accomplished against tank and non-tank targets. Warhead testing was also accomplished.

(2) (U) FY 1985 Program: Full function testing of the Skeet submunition will be done, and testing of the air bag dispenser subsystem is planned with high speed sled tests of the Skeet Submunition. A preliminary design review is planned for June 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full scale development continues in FY 1986 with live Skeet qualification testing. The Skeet effort will support the planned fourth quarter FY 1986 Critical Design Review of the Sensor Fuzed Weapon. The program cost was estimated using engineering buildup (grassroots) and parametric cost estimating techniques.

(4) (U) Program to Completion: After FY 1986 Skeet funding will be contained within PE 64607F, Sensor Fuzed Weapon. Sensor Fuzed Weapon completes full scale development in FY 1988 with the completion of Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E). Production is planned to begin in FY 1988.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Full Scale Development Start (Risk Reduction)	*July 1984
(2) (U) Critical Design Review	4th Qtr FY 1986
(3) (U) Production Release (Sensor Fuzed Weapon)	4th Qtr FY 1988

*(U) No milestones presented in FY 1985 Descriptive Summary.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64607F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Wide Area Anti-Armor Munitions
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		23,170	19,927	15,811	35,541	26,838	130,260
2581	Extended Range Antiarmor Munition (ERAM)	0	0	3,253	11,141	21,838	40,828
2961	Sensor Fuzed Weapon (SFW)	15,670*	19,927	12,558	24,400	5,000	81,932
3043	Submunitions	7,500*					7,500

* Includes Submunitions funding ($18.1 Million; $10.6 Million in Project 2961 and $7.5 Million in Project 3043). Following FY 1984 the funding is in PE 64604F.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Tactical Air Forces require a capability to destroy multiple enemy tanks during a single aircraft pass to overcome the existing large numerical imbalance of Warsaw Pact armor. This critical need is documented in the Mission Element Need Statement for an Improved Wide Area Anti-Armor Capability. The Sensor Fuzed Weapon (SFW) and Extended Range Anti-Armor Munition (ERAM) programs are outgrowths of the Wide Area Anti-Armor Munition (WAAM) umbrella program and were initiated to address the above need. This program will accomplish full scale development of SFW and ERAM. The submunition effort for SFW (Skeet) and ERAM is being accomplished in a separate program element PE 64604F, Submunition Development.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	23,500	27,306	12,558		Continuing	N/A
Other Procurement (PE 28030F)					TBD	TBD

(U) In FY 1985 the Congress cut SFW by $11 Million ($7.3 Million in PE 64607F and $3.7 Million in PE 64604F). In FY 1986, funding was added for the Extended Range Anti-armor Munition (ERAM) full scale development which was listed as TBD in the FY 1985 Descriptive Summary.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Sensor Fuzed Weapon						
Other Procurement: PE 28030F	0	0	0	0	TBD	TBD
Funds						
Quantities						
Extended Range Anti-Armor Munition						
Other Procurement: PE 28030F	0	0	0	0		
Funds					TBD	TBD
Quantities						

5. (U) RELATED ACTIVITIES: Sensor Fuzed Weapon technology support is ongoing in PE 62602F, Conventional Munitions; PE 63601F, Conventional Weapons Technology, and PE 64604F, Submunitions Development. Warhead, sensor, seeker, and dispenser technology programs in these program elements provide the basis for the Sensor Fuzed Weapon and Extended Range Anti-Armor Munitions concepts. Weapon concept demonstration/validation was accomplished in PE 63609F, Advanced Attack Weapons.

6. (U) WORK PERFORMED BY: Program management is provided by Headquarters Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Contractor support for the Sensor Fuzed Weapon is provided by AVCO Corporation, Wilmington, MA.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2581, Extended Range Anti-Armor Munition (ERAM). The Extended Range Antiarmor Munition (ERAM) is an air delivered mine used to slow or divert armor. This 1000 pound weapon will contain nine submunitions (mines) with two warheads each. The mine senses the approach of an armored vehicle and launches a submunition up and over the target. When the submunition detects the target a self forging slug is fired into the target. This program is a new start. The ERAM submunition developed in PE 64604F, Submunitions, will be integrated into the Tactical Munition Dispenser. The resulting 1000 pound weapon will will provide an improved capability. Full scale development is planned for late FY 1986. Production is planned for FY 1989.

Program Element: #64607F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: Wide Area Anti-Armor Muntions
Budget Activity: #4 - Tactical Programs

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2961, Sensor Fuzed Weapon

A. (U) Project Description: Sensor Fuzed Weapon (SFW) is a 1000 pound weapon which consists of a Tactical Munitions Dispenser packaged with 40 armor defeating warhead mechanisms. The warhead mechanism, commonly called Skeet, consists of a self-forging warhead and infrared detector which detects hot areas on the target and initiates the warhead. The smart Submunitions will provide multiple kills per single aircraft pass.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The Sensor Fuzed Weapon demonstration program was completed with full function testing of the Skeet Delivery Vehicle (SDV). Testing was encouraging enough to continue with a two phased program in FY 1984 to reduce risk. Phase I to demonstrate successful dispensing of the Skeet Delivery Vehicle and additional full function testing was initiated in FY 1984.

(2) (U) FY 1985 Program: Phase I risk reduction will be completed with additional testing of the Skeet Delivery Vechicle against heat generating targets. Phase II, full scale development, will begin with the preliminary design review and continue through FY 1985. The program will be restructured to reflect the impact of FY 1985 Congressional action reducing the FY 1985 funding by $11 Million. The positive ejection system design for submunitions dispersion will be completed and will undergo testing. Initial contractor testing of the complete Sensor Fuzed Weapon will start in FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full Scale Development (FSD) will continue in FY 1986. Integration tests into the dispenser and qualification tests will be completed. Contractor flight tests are planned, and Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) are scheduled for FY 1987 and will continue into FY 1988. Program cost is based on a cost estimate (between category III and IV) completed in May 1984.

(4) (U) Program to Completion: FSD is scheduled to be completed in FY 1988 following initial operational test and evaluation. Initial procurement is also planned in FY 1988. This procurement program will be conducted in PE 28030F, War Readiness Materiel Munitions.

C. (U) Major Milestones:

Milestones		Dates
(1) (U) FSD Contract Award	*(January 1984)	July 1984
(2) (U) Preliminary Design Review	*(October 1984)	July 1985
(3) (U) Critical Design Review	*(January 1986)	December 1986
(4) (U) Air Force Systems Acquisition Review Council (AFSARC II)	*(February 1986)	2nd Qtr FY 1987
(5) (U) Initial Production Release	*(May 1987)	4th Qtr FY 1988

*Date in FY 1985 Descriptive Summaries.

EXPLANATION OF MILESTONE CHANGES:

(1, 2, 3, 4): Full scale development and subsequent dates were delayed when the program was restructured to limit Government liability during full scale development.

(5): Initial production was slipped to align it with the completion of Development Test and Evaluation/Initial Operational Test and Evaluation.

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E):

(U) Validation Phase: Development testing of the Sensor Fuzed Weapon (SFW), by AVCO Corporation, was completed in January 1984. All test objectives were met except for the full-function test of the submunition dropped from a cable and flight test of the air bag dispensing subsystem. The submunition released from the cable above the targets, the parachute deployed and jettisioned, the rocket motor ignited and the four Skeets were released properly. The first Skeet detected what it thought was a target and fired. The remaining three Skeets fired immediately thereafter, also missing their targets. This apparent fratricide (one Skeet firing and initiating the remaining) has been identified as a significant risk and will be addressed and retested early in the risk reduction phase. Time and funding did not allow testing of the air bag dispensing subsystem.

(U) Risk Reduction Phase: During the SFW risk reduction phase the design changes made to solve the fratricide problem experienced in validation will be tested in a repeat of the full-function test. The air bag dispensing subsystem will be flight tested. The goal is to have test results available by mid FY 1985 to support a decision for continued development of SFW. Testing will be done at Sandia Laboratory, Albuquerque, New Mexico and Eglin AFB, Florida.

(U) Full Scale Development: DT&E will be combined with the Initial Operational Test and Evaluation (IOT&E). The majority of DT&E will be conducted by the Air Force Systems Command Armament Division. Some subsystem tests, environmental tests, and military qualification tests will be conducted by the contractor at his facility. The SFW DT&E/IOT&E testing is scheduled to be conducted during Fiscal Years 1987 and 1988. The primary test objectives for the phase are to: (1) establish baseline system performance characteristics, (2) verify the predicted number of kills per pass against specified targets, and (3) determine the effect of probable countermeasures on system performance. An assessment of the system support concept in meeting logistics requirements will be made. The Air Force Operational Test and Evaluation Center will have the overall management responsibility for the IOT&E program. (Their effort is discussed in paragraph 2 below.) The combined DT&E/IOT&E program will include approximately 64 SFW all-up-rounds. As with the validation testing, the majority of the DT&E/IOT&E will be conducted at Eglin Air Force Base; however, other test ranges such as those at China Lake and Camp Drum are likely to be used. The Extended Range Antiarmor Munition (ERAM) will not enter full scale development until late FY 1986, and DT&E/IOT&E is planned for FY 88 and FY 89.

(U) The SFW and ERAM DT&E/IOT&E hardware will be very similar, if not identical, to the planned production hardware. Many of the planned production processes will be used to manufacture the test hardware. System reliability, availability, and logistics support will be tested during this phase.

2. (U) Operational Test and Evaluation (OT&E): The Wide Area Antiarmor Munitions (WAAM) concept will require operational test and evaluation (OT&E) for each of the munition concepts: (1) the Extended Range Antiarmor Muntion (ERAM) and (2) the Sensor Fuzed Weapon (SFW). Air Force Operational Test and Evaluation Center (AFOTEC) has been assigned overall management responsibility for ERAM and SFW IOT&E programs. The first phase of IOT&E(1) is conducted prior to Milestone II. AFOTEC monitors contractor Demonstration and Validation (D&V) and early Full-Scale Development (FSD) testing. The second phase of IOT&E, IOT&E(2), is conducted after Milestone II using dedicated AFOTEC test items. IOT&E(1) is underway for ERAM and SFW.

(U) Demonstration and Validation Phase. During this phase, component and submunition development tests are conducted by the contractor with some tests conducted by Air Force Systems Command (AFSC) at Eglin AFB, Fl. AFOTEC participates in D&V to estimate, as much as possible from the data available, the projected operational effectiveness and suitability of each concept. The objective of IOT&E(1) is to estimate the kills per pass obtained by each concept in a realistic operational environment. This will be accomplished primarily by evaluating computer simulation results and component test data.

(U) Full Scale Development. IOT&E will be conducted by AFOTEC during FSD concurrent with DT&E. DT&E/IOT&E(2) test events will be combined where feasible. Separate IOT&E(2) will be conducted for test objectives which cannot be combined with DT&E. DT&E/IOT&E(2) is projected for FY 1987/FY 1988 (SFW) and for FY 1988/FY 1989 (ERAM). Common WAAM IOT&E(2) objectives for operational effectiveress during this phase are: (1) measure the expected number of kills per pass against armored target arrays, (2) estimate WAAM performance in various battlefield and countermeasures environments, (3) estimate the ability of ERAM and SFW to discriminate between real and false targets, (4) estimate operational reliability, and (5) estimate the effect of target location error. An objective unique to ERAM is to measure its ability to disrupt or delay the movement of armor. The operational suitability objectives include determining the availability, maintainability, reliability, and logistics supportability of the systems. No unique suitability problems are anticipated and test assets used during DT&E/IOT&E(2) will be items which are representative of production items. US Air Force personnel will operate and maintain each WAAM munition throughout each IOT&E program. Test assets programmed exclusively for IOT&E(2) are: SFW - 36 Cluster Bomb Unit (CBU) rounds and ERAM - 54 CBU rounds. At this time specific subsystems and support equipment requirements have not been identified. Test program requirements for each concept will be defined as more data become available.

(U) Specific test locations have not been determined for SFW or ERAM. It is likely that the Eglin AFB land range will be the primary test site. The Naval Weapons Center, China Lake, CA, and Ft Drum, NY are being considered. Safety will be a prime consideration in test range selection due to the large lethal footprints of the SFW and ERAM systems.

Budget Activity: 4, Tactical Programs
Program Element: 64607, Wide Area Antiarmor Munitions (WAAM)

3. (U) System Characteristics: Characteristics for the Sensor Fuzed Weapon (SFW) will be definitized during the FSD phase. The primary objectives of the program are to develop a system that can achieve multiple kills per pass against massed armor targets. Specific thresholds for the SFW system will be identified before the Air Force Systems Acquisition Review Council II.

Characteristic	Objective (Goal)	Demonstrated
SFW		
(U) Target Set	Tanks, Self-Propelled Artillery (SPA), Armored Personnel Carriers (APC), Trucks	TBD
(U) Wide Area Lethality	900 ft x 1200 ft area	TBD
(U) Low Level Delivery	200 ft (60m)	TBD
(U) Warhead Capability	Senior National Representatives (SNR) Range Target	Target Defeated
(U) Service Life	10 years	TBD

Extended Range Antiarmor Munition (ERAM)
(U) Specific characteristics will be identified once validation is completed.

(656)

Budget Activity: 4, Tactical Programs
Program Element: 64607F, Wide Area Antiarmor Munitions (WAAM)

4. (U) Current Test and Evaluation (T&E): All Sensor Fuzed Weapon (SFW) and Extended Range Antiarmor Weapon (ERAM) testing to date has been conducted by the system contractor, AVCO.

Event	T&E Activity (Past 12 Months) Planned Activity	Actual Date	Remarks
SFW			
Prototype Live Full Function Demonstration Tests	December 1983	January 1984	Demonstration not completely successful. Test will be performed again in full development.
ERAM			
Prototype Demonstration Test	2 & 4 Qtr FY 1984	July 1984	

Event	T&E Activity (Next 12 Months) Planned Date	Remarks
SFW		
Air bag dispenser flight demonstration	3rd Qtr FY 1985	To demonstrate proper dispensing of submunitions.
SFW		
Live Full Function Test	3rd Qtr FY 1985	To insure cause of validation test failure has been fixed.
SFW		
Preliminary Environmental Tests	4 Qtr FY 1985	Preliminary environmental testing of Skeet, submunition and dispenser.
ERAM		
Prototype Demonstration Tests	To be determined	Prototype testing may be continued into FY 1985

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64617F
DOD Mission Area: 225 - Air Warfare Support

Title: Air Base Survivability and Recovery
Budget Activity: 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		7,567	11,592**	21,900	26,751	Continuing	N/A
2621	Rapid Runway Repair	4,400	10,000**	9,400	8,500	Continuing	N/A
2895	Air Base Survivability	3,167	1,592	9,300	10,651	Continuing	N/A
3141	Camouflage, Concealment, and Deception	(1,000)*	(989)*	3,200	7,600	Continuing	N/A

* FY 1984 and 1985 Advanced Development effort was funded in PE 63307F, Air Base Survivability and Recovery.
** Does not include $1,242 for damage assessment development.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Sustained airfield operations are a prerequisite for war planning and successful war fighting. Base and theater commanders must have the capability and resources to defend their main or forward airfields and also return them to operational status after sustaining an attack. This program focuses on integrating numerous ongoing efforts and providing for full-scale development for selected systems.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,106	18,092	23,992		Continuing	N/A
Missile Procurement	67,801	23,652	11,700		Continuing	N/A
Other Procurement	51,211	94,784	237,282		Continuing	N/A

FY 1984 RDT&E funding was increased to properly fund the Alternate Launch and Recovery Surface for SALTY DEMO and to provide for preliminary evaluation of portable airfield lighting. RDT&E and procurement funding in FY 1985 was reduced by Congressional action. Additionally, RDT&E and procurement were reallocated to provide an orderly progression of projects through development into production. Finally, the procurement shown below is limited to that associated with the above RDT&E projects; the FY 1985 Descriptive Summary included additional related procurement not directly associated with the projects.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Project 2621 Rapid Runway Repair (PEs 12896F, 27596F, 41896F, 72896F, and 28032F)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	1,187	15,318	22,085	60,580	Continuing	N/A
Quantities	Not Applicable.					

		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	Military Construction:						
	Funds	0	0	2,200	14,188	Continuing	N/A
	Stock Fund:						
	Funds	0	0	4,205	1,628	Continuing	N/A
Project 2895	Air Base Survivability (PEs 12896F, 27596F, 41896F, and 72896F)						
	Other Procurement:						
	Funds	308	4,102	10,976	23,099	Continuing	N/A
	Quantities	Not Applicable.					
Project 3141	Camouflage, Concealment & Deception (PEs 12896F, 27596F, and 41896F)						
	Other Procurement:						
	Funds	0	0	0	5,554	Continuing	N/A
	Quantities				5		
	Military Construction:						
	Funds	0	0	670	2,522	Continuing	N/A

5. (U) RELATED ACTIVITIES: This program transfers the advanced development efforts in Program Element 63307F, Air Base Survivability and Recovery, and Rapid Runway Repair projects in Program Element 63723F, Civil/Environmental Engineering Technology, to Full-Scale Development. Procurement is executed primarily through PE 27596F for tactical forces, PE 12896F for defensive forces, PE 41896F for airlift, and PE 72896F for logistics support.

6. (U) WORK PERFORMED BY: The in-house development organization responsible for elements of the program are the Armament Division at Eglin AFB, FL; Aeronautical Systems Division at Wright-Patterson AFB, OH; and the Air Force Engineering Services Center at Tyndall AFB, FL.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2621, Rapid Runway Repair. This full-scale development project provides the technology, procedures, and equipment to rapidly repair crater and surface spalls caused by bombs and other enemy action to runway and taxiway pavements. These functions are critical path activities which must be accomplished before an air base can return to combat operations. The major technical thrusts are: (1) Damage assessment - develop systems and procedures to quickly survey and analyze the extent and nature of battle damage and unexploded ordnance. (2) Bomb Damage Repair -

develop the materials, equipment, procedures, and manuals to repair a full spectrum of conventional munitions damage. (3) Surface Roughness Criteria - determine the rough-field tolerance of existing aircraft and in turn derive surface roughness criteria for determination of the required operating surface repair. (4) Alternative Launch and Recovery Surfaces - develop pavement technology to provide a low cost alternative launch/recovery surface which can be immediately available for aircraft operations following an airfield attack In FY 1984, development continued on a microcomputer-based system for evaluation of the damage and the extent of unexploded ordnance on an airfield to permit expeditious selection of a Minimum Operating Strip -- a small operating strip just big enough for launch and recovery of aircraft. Surface roughness testing was accomplished on the F-111, and surface roughness criteria for the F-16, F-15, and C-5 were largely completed. Extensive work on alternate launch and recovery surfaces was accomplished including construction work on the prototype surface at Spangdahlem Air Base, Germany, to be tested in the "SALTY DEMO" capability demonstration in FY 1985. Effort began on development of blast hardening kits to protect critical heavy equipment against conventional munitions effects; designs of kits for four types of equipment were completed. Efforts directed at improvement in crater and spall repair will continue in FY 1985 toward the objective of fielding an incremental, improved capability by late FY 1985. This cabability will use either precast concrete slabs or crushed stone with a fiberglass cover. It will cut individual crater repair time in half and triple the number of large craters which can be repaired simultaneously. FY 1985 development of software for Minimum Operating Strip selection will continue with emphasis on tailoring it to the specifics of bases in Europe and the Pacific. Also in FY 1985 extensive testing of the Alternate Launch and Recovery Surface is planned. In FY 1986, development of improved runway and taxiway repair capabilities will continue with full-scale development of a structural cap crater repair system. This system will use advanced polymer technology, materials, and unique equipment to implant rapid setting polymer concrete. It will eliminate the need for a prefabricated cap on craters while meeting the full requirement for repair times. The repair will provide a semi-permanent surface which is flush with surrounding, undamaged pavement. An additional advantage is that it requires very little maintenance. There will also be effort on development of damage resistant pavement surfaces and specification of revised design criteria for runways and taxiways.

B. (U) Project: 2895, Air Base Survivability. Air Base Survivability is a diverse, interrelated project with effort in a number of subareas. It includes development of an Air Force explosive ordnance disposal system to conduct wide area render safe operations and remove unexploded ordnance following an attack upon the airfield. Removal of ordnance is on the critical path for restoration of combat operations. The existing approach, largely unchanged over the past forty years, is labor intensive and very time consuming. Improvements are needed to provide more efficient ordnance disposal capabilities. Also included is development of aircraft ground mobility capabilities to improve an aircraft's ability to move across runways and taxiways damaged by attack or around the battle damage on rough, soft areas off the prepared surfaces. Longer term effort will address development of systems to reduce susceptibility to foreign object damage to aircraft traveling over damaged or unprepared surfaces. Development of alternate takeoff techniques to maximize the capability to launch aircraft from relatively short runways will also be addressed. This capability will enhance post attack launch options and complicate the enemy's problem of targeting attacks to inhibit takeoff operations. Development of a portable airfield lighting system is required to provide for night operations on minimum operating strips and alternate launch and recovery surfaces. Measures to limit damage from an airfield attack as well as other capabilities to quickly restore operations after an attack will also be developed in this project.

In FY 1984, a study to define a systems approach and roadmap for explosive ordnance disposal system development was initiated. Integration of the Ordnance Rapid Area Clearance System was substantially completed. This system will provide an interim capability to expeditiously clear small unexploded ordnance from airfield pavements. Planning was initiated for a Standoff Munitions Disrupter System to provide a much more rapid and safe capability to neutralize larger unexploded ordnance by using precision sighted guns at standoff position. Full-scale development of a system for improved ground mobility of the F-16 was initiated, and studies were initiated for development for a number of other aircraft. A study was conducted on reducing F-16 susceptibility to foreign object damage when taxiing over rough and battle damaged areas. A feasibility study on using ramp assisted takeoff was evaluated by examining results of Navy ski jump tests. In FY 1985, the explosive ordnance disposal systems approach study will be completed. Computer simulations of short takeoff ramps will continue including evaluation of operations using earth and concrete ramps as inexpensive alternate launch structures. Full-scale development of a system for improved ground mobility of aircraft will continue. The focal point for FY 1985 effort is a demonstration of improvements to Air Base Survivability in an operationally realistic scenario. The demonstration will bring together all critical base sortie generation functions required to survive a chemical/conventional airfield attack and sustain combat air operations. This demonstration, called "SALTY DEMO", will be staged at Spangdahlem Air Base, Germany, in the spring of 1985. Late in FY 1985, development of a portable airfield lighting system will be initiated. In FY 1986, effort will continue in the areas of explosive ordnance disposal, aircraft ground mobility, and ramp assisted takeoff. Explosive ordnance disposal system development will concentrate on full-scale development of the Standoff Munitions Disrupter system. Full-scale development of a system for improved F-16 ground mobility will continue, and flight test evaluation of ramp assisted takeoff will begin. Also in FY 1986, development of portable airfield lighting will continue, and earth-reinforced aircraft shelter designs will be tested. Full-scale development of an Air Base Survivability Information Integration system will begin in late FY 1986. This effort addresses the problem of assimilating and integrating the variety of information including the chemical environment on the base, the status of explosive ordnance disposal, and runway and facility repair actions.

C. (U) Project: 3141, Camouflage, Concealment, and Deception. This project embraces a full spectrum of Camouflage, Concealment, and Deception (CCD) methods to mitigate the effectiveness of enemy attacks against airfields. Effort prior to FY 1986 has been advanced development effort funded in PE 63307, Air Base Survivability and Recovery. It also embodies the concepts and reflects the emphasis of "Tactical Deception in Air-Land Warfare" delineated in a 19 Aug 83 SECDEF Memorandum. The project includes, but is not limited to, development of aircraft decoys, atmospheric obscuration concepts, and optical and radio frequency sensor deception. Full-scale development of CCD elements begins in FY 1986. Priorities for development are the following: (1) General Camouflage - development and integration of various techniques into a system for large area camouflage. (2) Decoys - development primarily of aircraft decoys. (3) Corner Reflectors - development of a system of radar reflectors for the purpose of camouflage and deception. (4) Nets - development of large, lightweight camouflage nets for concealment and camouflage of equipment and facilities. These efforts are to be focused on a near-term capability (FY 1987).

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64703F
DOD Mission Area: #255 - Air Warfare Support

Title: Aeromedical/Chemical Defense Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,774	7,007	8,049	14,083	Continuing	N/A
2866	Aeromedical/Chemical Defense Systems	3,774	7,007	8,049	14,083	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force has limited capability to treat and evacuate wartime casualties incurred in a chemical warfare or conventional warfare environment and no adequate means of improving this capability. This program will develop field deployment medical equipment systems for the treatment and evacuation of wartime casualties in a chemical or conventional warfare environment. This program will also provide tactical and strategic aeromedical evacuation systems and Air Force unique field medical treatment equipment (second echelon units), required to fulfill Department of Defense and Air Force needs.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	3,824	7,007	9,726		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: The Air Force Aeromedical/Chemical Warfare Defense Systems Development Program has performed extensive coordination with other services (U.S. Army Medical Research and Development Command and U.S. Navy Medical Research and Development Command). Efforts that are unique to the Air Force (Tactical and Strategic Aeromedical Evacuation and the Air Force Second Echelon System) will be addressed in this program. PE 63745F, Chemical Warfare Defense will transition advanced development efforts of Air Force unique requirements to this program. In addition, a memorandum of agreement has been established with the U.S. Army Medical Research and Development Command to jointly pursue some of these programs, as appropriate. This program is coordinated on an international basis through the NATO/Military Agency for Standardization. Air Force operational commands are and will continue to be involved throughout the development process.

6. (U) WORK PERFORMED BY: This program will be conducted by the Aeromedical/Casualty Systems Program Office, Systems Acquisition Directorate, Aerospace Medical Division, Brooks AFB, TX. The program will be primarily contractual efforts.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2866, Aeromedical/Chemical Defense Systems.

A. (U) Project Description: The project will develop medical equipment and systems for treatment and evacuation of wartime casualties in a chemical or conventional warfare environment. It will also provide tactical and strategic aeromedical evacuation systems field medical treatment equipment (second echelon units), needed to fulfill Department of Defense and Air Force operational requirements. Casualty rates will significantly increase with the introduction of chemical warfare into a conventional conflict and limit the effectiveness of the Air Force Medical Mission. Urgent requirements identified by the Major Commands for the treatment and evacuation of wartime casualties are the basis for the program. The ability to isolate the casualties from further chemical agent contamination, to allow medical personnel to render effective treatment under these conditions, and to adequately transport the casualties are key to the success of the Air Force Medical Mission.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The program initiated engineering development that will lead to production/field deployment of the second echelon medical survivable collective protection system, mobile medical collective protection system, portable liquid oxygen system for patients on aeromedical evacuation C-130 aircraft, ambulatory casualty chemical protective system, chemical agent protected intravenous system, C-141 aircraft therapeutic oxygen manifold system, aeromedical electrical distribution system and chemical warfare contamination control area.

(2) (U) FY 1985 Program: The FY 1985 program will continue the full-scale development efforts started in FY 1984. In addition, engineering development efforts will be initiated including: chemical warfare protective oxygen generation system, therapeutic airborne treatment system, nasal gastric airway suction system, chemical warfare patient ventilator system, chemical warfare hardened first aid kits, chemical warfare contamination detection system, and automated patient information system.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 program will be a continuation of projects initiated in FY 1984-85, with the following anticipated starts: chemical warfare patient/personal dosimeter, life detector/vital signs monitor, chemical warfare decontaminable litter and chemical warfare patient/attendant communication system. The cost estimates used in developing the funds requested for this program are based upon similar chemical warfare defense advanced development and engineering development efforts. These estimates are based on competition.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Portable Therapeutic Liquid Oxygen	FY 1986
(2)	(U)	CW Patient Ventilator	FY 1986
(3)	(U)	CW Protective Oxygen System	FY 1986
(4)	(U)	Ambulatory Casualty Wrap and IV System	FY 1986
(5)	(U)	Transportable Airborne Therapeutic Station	FY 1986
(6)	(U)	Chemical Warfare (CW) Contamination Control Area	FY 1987
(7)	(U)	Survivable Collective Protection System - Medical	FY 1987
(8)	(U)	Transportable Collective Protection System - Medical	FY 1987
(9)	(U)	CW Patient Personnel Dosimeter	FY 1987
(10)	(U)	Life Detector/Vital Signs Monitor	FY 1987
(11)	(U)	CW Patient Contamination Detection System	FY 1987
(12)	(U)	Nasal Gastric Airway Suction System	FY 1987
(13)	(U)	CW Decontaminable Litter	FY 1987
(14)	(U)	Automated Patient Information System	FY 1989
(15)	(U)	CW Patient/Attendant Communication System	FY 1987

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64706F
DOD Mission Area: 225 - Air Warfare Support

Title: Life Support System
Budget Activity: 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		12,980	13,573	16,779	22,685	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to provide centralized management and development of life support equipment and subsystems necessary to assure maximum functional capability of aircrews throughout all mission environments and to enhance safe escape, descent, survival, and recovery in emergency situations. Also provides for development, test, and standardization of emergency equipment and protective clothing and devices for non-flying personnel. This is the only Air Force program element devoted to engineering development of life support equipment and contains a number of joint service endeavors.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	14,689	15,649	19,852		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: The procurement of life support equipment is accomplished under several weapon systems and air base support program elements. Funding for initial production of replacement items is normally provided by the Air Force Logistics Command system or item managers under various budget authorizations. Government Furnished Aeronautical Equipment acquisitions are funded by weapon system program elements. New items being introduced into the inventory for the first time are programmed by Air Force Systems Command and budgeted under aircraft program elements; the thermal/nuclear flashblindness goggles for the Strategic Air Command are procured under Air Base Support Program Elements; High Flow Anti-G Valves for Tactical Air Command are procured under the F-15, F-16, and A-10 program elements.

5. (U) RELATED ACTIVITIES: There are several program elements which provide exploratory development that contribute to full-scale development of life support equipment. Among these are Program Element 62201F, Aerospace Flight Dynamics; Program Element 62202F, Aerospace Biotechnology; Program Element 63205F, Flight Vehicle Technology; Program Element 64601F, Chemical/Biological Defense Equipment; Program Element 62723A, Clothing, Equipment and Shelter Technology; Program Element 63747A, Clothing and Equipment, Soldier Support/Survivability; Program Element 64204A, Air Mobility Support Equipment; Program Element 64713A, Combat Feeding, Clothing and Equipment; Program Element 62241N, Ejection Seat Bio-Dynamics; Program Element 62758N, Biomedical Technology; Program Element 63216N, Mission Oriented

Clothing and Devices; and Program Element 64264N, Life Support Equipment. All tasks within this program are coordinated with the other Services. A formal Tri-Service Steering Committee was established in 1980 to achieve standardization and prevent duplication of effort.

6. (U) WORK PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command, located at Wright-Patterson Air Force Base, Ohio, provides program management responsibility. Close interaction is maintained with other Air Force Systems Command product divisions, test centers and laboratories. Support is also provided by other Service organizations, i.e., the Army Natick Research and Development Command, Natick, Massachusetts; Naval Ordnance Station, Indian Head, Maryland; and Naval Air Development Center, Warminister, Pennsylvania. The major contractors in FY 1985 are: Douglas Aircraft Company, Long Beach, California; Irvin Industries Canada, Ltd, Ft Erie, Ontario; Cubic Corporation, San Diego, California; Bendix Corporation, Davenport, Iowa; Motorola, Phoenix, Arizona, and fourteen other contractors.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64706F, Life Support System.

A. (U) Project Description: The Life Support System is composed of two major areas. The first includes the development or improvement of aircrew equipment such as flight clothing, oxygen equipment, helmets, anti-g pressure suits and valves, nuclear flashblindness goggles, aircrew armor, ejection seats, restraint harnesses, parachutes, cartridge and propellant actuated devices, life preservers, rafts, anti-exposure suits, arctic clothing, survival kits, escape and evasion devices, survival radios, and survivor location systems. The other area includes the development or improvement of life support equipment for non-flying personnel with equipment and protective clothing necessary to maximize both their functional contribution to assigned missions and to enhance the probability of their survival during emergency situations. The program provides for continual design, development, and test of personal equipment, mission related equipment, and aircraft installed life support equipment.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Continued ongoing development tasks. Included were: Tri-Service Survival Avionics System for Search and Rescue; non-helmeted thermal flashblindness devices for the Tactical Air Command, Military Airlift Command and Strategic Air Command; joint United States Air Force/Canada Automatic Inflation Modulation Parachute; lightweight helmet for the Tactical Air Command; high performance anti-g systems (valves and suits) for high acceleration aircraft; active arm and leg restraint systems for high speed ejection; advanced aircrew armor for the Military Airlift Command; pararescue radios and other smaller life support efforts. Additional development tests included: vacuum packed sleeping bags; safety toed arctic boots and a one-piece arctic fire

retardant flying coverall for the Alaskan Air Command; vacuum packed one-man life rafts; and smoke masks for ground alert personnel for the Strategic Air Command.

(2) (U) FY 1985 Program: Continue with development efforts begun in previous years. Specific efforts include: MBU-12/P oxygen mask improved communications; ejection seat limb restraint system; Survivor Location System and PRC-112 survival radio. Complete development testing of high performance anti-g valves, Seawater Activated Parachute Release Systems, Automatic Life Preserver, multi-place life rafts for Military Airlift Command and Strategic Air Command, and arctic cold weather clothing.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continue with critical development efforts begun in previous years. Specific efforts include initiation of life support system development efforts in support of the Advanced Tactical Fighter. These tasks will emanate from the advanced development efforts now underway at the Aerospace Medical Division, Brooks AFB, Texas, as the technology matures enough to allow full-scale development to begin. Other new development tasks are development of a data base and management system to identify aircraft mishaps caused by human factors design problems and an underwater escape breathing system for helicopter aircrews. Complete several Advanced Concept Ejection Seat II ejection system development efforts in preparation for sled testing in FY 1987. Conduct Developmental Test and Evaluation/Initial Operational Test and Evaluation of systems developed in previous years. Cost estimates are based on detailed implementation plans prepared by field agencies each year and are a mixture of fixed price contracts, grassroots, and parametric estimates.

(4) (U) Program to Completion: This is a continuing program. Full-scale development efforts will be initiated based on the life support master development plan which identifies and integrates life support development efforts for the next 10 years. These development efforts will focus on air and ground life support and space needs.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64708F
DOD Mission Area: 225 - Air Warfare Support

Title: Other Operational Equipment
Budget Activity: 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		11,576	21,835	17,087	18,934	Continuing	N/A
2054	Aerospace Facilities Engineering Development	800	760	1,466	3,526	Continuing	N/A
2479	Common Support Equipment Development	165	102	1,174	4,014	Continuing	N/A
2505	Firefighting, Suppression and Rescue	350	700	782	979	Continuing	N/A
2674	Tactical Shelters	611	1,173	1,568	2,000	Continuing	N/A
2783	Ground Power Generator Development	8,000	12,100	4,988	3,905	196	35,700
3080	Generic Integrated Maintenance Diagnostics	1,650	7,000	7,109	4,510	2,686	22,955

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops, tests, and evaluates improvements to flightline common support equipment; tactical shelters; and firefighting, pollution abatement, and air base facility systems. Special/peculiar needs of various theaters of operation, including those of the rapid deployment forces, are addressed.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	9,956	22,846	21,469		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Aircraft Procurement Funding Source: BP 1200 Common Aerospace Ground Equipment related to Project 2479, Common Support Equipment Development.

5. (U) RELATED ACTIVITIES: Program Element 63723F, Civil and Environmental Engineering Technology, provides advanced development for projects 2054 and 2505. Close cooperation is maintained with other services via the Joint Logistics Commanders Panel on Support Equipment, the Joint Committee on Tactical Shelters, and the Joint Services Civil Engineering Research and Development Coordinating Group.

6. (U) WORK PERFORMED BY: The top five contractors ($25,000 or more) are Teledyne Continental Motors, Mobile, AL, and Ingersoll Rand, Mocksville, NC, (both for project 2783, Ground Power Generator Development); Standard Manufacturing, Dallas, TX, and Technology Incorporated, Dayton, OH (both for project 2479, Common Support Equipment Development); Fire Research Corporation, Nesconset, NY (project 2505, Firefighting Suppression and Rescue). There are ten additional contractors with a total dollar value of $925,000. The in-house developing organizations are: for projects 2479, 2783, and 3080, the Air Force Systems Command's Aeronautical Systems Division, Wright Patterson AFB, OH; for projects 2054 and 2505, the Air Force Engineering and Service Center, Tyndall AFB, FL; and for project 2674, Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2054, Aerospace Facilities Engineering Development. This project addresses four task areas: air base survivability/vulnerability; environmental engineering; aircraft operational surfaces; and facilities energy and resource conservation. To support the mission, the Air Force must continue to improve the survivability of aerospace facilities and resources. Also, the Air Force must meet Environmental Protection Agency standards. The United States Air Force Academy Boiler Emissions Handbook, development of procedures for using biomass, and development of durable airfield markings were completed in 1984. Tasks planned in 1985 are: initiate full-scale development (FSD) efforts for the Air Force Installation Restoration Program to reduce pollution on air bases, perform FSD of methods to determine the presence, concentration, and movement of toxic pollutants in Air Force facilities' environs; perform field tests of asphalt recycling techniques; and validate designs of valves, walls, and doors on existing semihardened personnel shelters. In 1986, the program will continue the FSD efforts for the Installation Restoration Program and testing of asphalt recycling techniques. Also, FSD of devices for remote sensing of toxic vapors and an automated system for characterization of engine exhaust emissions will be initiated.

B. (U) Project: 2479, Common Support Equipment Development. The objective of this project is to develop standardized flightline ground support equipment. Standardized support equipment reduces proliferation, is more effective, has lower life cycle cost, increased mission support capability, and a greater return on investment than support equipment currently used for similar tasks. In 1984, Initial Operational Test and Evaluation of two classes of universal aircraft towbars were performed. Plans for 1985 are to continue development of universal aircraft towbars and initiate Standard Hydraulic Test Stand development. The Test Stand will replace approximately 30 different configured systems in the current inventory. The 1986 plan is to complete development of universal aircraft towbars and continue development of the Standard Hydraulic Test Stand.

C. (U) Project: 2505, Firefighting, Suppression and Rescue. This project develops fire suppression and rescue equipment, materials, and methods to improve Air Force fire protection effectiveness, mobility, and wartime readiness. In 1984, development, test and evaluation (DT&E) of a prototype optimum aircraft rescue tool and the five-year-safe-use proximity firefighting suit were performed. The suit is a component of a proximity firefighting ensemble. Also development continued on the Capsulized Fire Extinguishing System and P-4 Fire Truck Simulators. The 1985 program will continue development of a firefighting ensemble that protects against a chemical/biological

environment and a fire suppression system for hardened aircraft shelters. Development of a Dehydrated Aqueous Film Forming Foam is currently ongoing. The plan for 1986 is to: initiate full-scale development (FSD) of the P-2 fire truck simulator: continue FSD of the fire suppression system for hardened aircraft shelters; improve the rescue vehicle and the proximity firefighting ensemble; initiate development of a situation simulator to teach hoseline operations and augment the vehicle simulators; and complete FSD of the Capsulized Fire Extinguishing System, Dehydrated Aqueous Film Forming Foam and the P-4 and P-19 Fire Truck Simulators.

D. (U) Project: 2674, Tactical Shelters. This project provides for development and acquisition of tactical shelter systems for Air Force tactical and strategic operations. There is a need to improve and standardize tactical shelter designs. Accomplishments in 1984 were: intitiated corrections of the electromagnetic pulse deficiencies; initiated investigation of chemical agent hardening and blast testing of the fiber reinforced plastic shelter; and initiated finite analysis of the S-280 shelter. Plans for 1985 are to initiate the hardened shelter components effort. The 1986 program will continue FSD of tactical shelter structural design, improved shelter materials and improvements to current shelters.

E. (U) Project: 2783, Ground Power Generator Development. The objective of this project is to design, develop, test and evaluate a fuel efficient flightline generator set and compatible air conditioner that are easier to maintain than the current equipment. The target fuel usage rate for the new generator is 16 gal/hr vs 48 gal/hr for the current generator, thereby saving approximately 1 billion gallons of fuel during a 20 year life cycle. Production units will replace current inventory (A/M32A-60A generators and A/M32C-10 air conditioners) on an as required basis. In 1984 FSD contracts were awarded to two contractors for three prototypes of two competitive designs. Plans for 1985 are to complete all prototypes of the Ground Power Generator, perform Developmental Test and Evaluation, and initiate Operational Test and Evaluation (OT&E) on all prototypes. OT&E of prototypes will continue in 1986.

F. (U) Project: 3080, Generic Integrated Maintenance Diagnostics (GIMADS). GIMADS will provide a generic, expandable, integrated maintenance diagnostics methodology and process with an early demonstration of a GIMADS application to the B-1B to increase the experience base. The development process will include specific tasks addressing individual elements of the diagnostics spectrum. The overall purpose of Generic Integrated Maintenance Diagnostics (GIMADS) is to optimize the mix of diagnostic elements on any given weapon system to best approach the goal of 100% fault detection and fault isolation. The 1984 effort was to award a contract to develop and procure two Centralized Integrated Test System (CITS) ground processors for the B-1B. The plan for 1985 is to award contracts for GIMADS and B-1B CITS Expert Parameter System (CEPS) concept phases to include B-1B CEPS prototype development using the CITS ground processors. The 1986 program will complete the GIMADS concept development phase and the B-1B CEPS prototype development and plan for an operational B-1B CEPS capability demonstration in FY 1987.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64710F
DOD Mission Area: #327 - TIARA for Tactical Air Warfare

Title: Reconnaissance Equipment
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		10,901[1]	8,780	7,820	13,748	Continuing	N/A
1155	Electro-Optical Collection/ Reconnaissance (COMPASS SEVEN)	4,807	3,424	4,920	12,248	Continuing	N/A
2337	Advanced Reconnaissance Sensor (ADRES)	2,494	3,756	0	0	0	N/A
2704	Tactical Electronic Reconnaissance (TEREC)	100	1,600	2,900	1,500	Continuing	N/A

1/In addition to the projects listed there is another $3,500 thousand in the PE for a special access project.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Projects in this program element support Air Force and other agencies reconnaissance/intelligence collection requirements by providing engineering development of airborne and ground sensors and associated equipment used to collect, record, and process imagery and electronic warfare data. Some systems developed under this program element become engineering prototypes for follow-on production of operational systems. Certain projects develop unique intelligence gathering sensor systems for special one-of-a-kind tasks.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	8,382	9,631	25,372		Continuing	N/A

FY 1984 increase due to funds added for a special access project. FY 1985 decrease caused by reprogramming action from COMPASS SEVEN project. Cut delayed some work on the COMPASS ERA upgrade. FY 1986 and outyear funds from the ADRES project have been transferred to the Advanced Tactical Air Reconnaisance System (ATARS) program, PE 63239F.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

PE #: 64710F

5. (U) RELATED ACTIVITIES: PE 63743F, Electro-Optical Warfare, and PE 63208F, Reconnaissance Sensors/Processing Technology, provide advanced development technology inputs to this program element. Procurement funds for new sensors and/or aircraft modifications resulting from this program, such as the Tactical Electronic Reconnaissance (TEREC) System, are provided by PE 27213F, RF-4C Squadrons. Procurement funds for ground exploitation facilities, such as TEREC processing are generally provided by PE 27431F, Tactical Air Intelligence Systems Activities and PE 27213F, RF-4C Squadrons. Air Force Logistics Command provides support for RC-135 modifications for PE 64710F projects. Tactical sensor development addresses requirements for sensor capabilities as identified by the Advanced Tactical Air Reconnaissance System (ATARS) program, PE 63239F. All projects in this program element are coordinated with the Major Commands and/or the National Security Agency groups directly involved.

6. (U) WORK PERFORMED BY: Texas Instruments, Dallas, TX, Tactical Electronic Reconnaissance (TEREC) Remote Terminals and TEREC data processing in the Tactical Information Processing and Interpretation (TIPI) facility, Project 2704); AMECOM/Division of Litton Industries, College Park, MD, (TEREC airborne sensors, Project 2704); Vought Systems Division, Grand Prairie, TX, (electro-optical systems, Project 1155); and Martin Marietta, Orlando, FL, (laser detection devices, Project 1155). Responsible agencies of the Air Force Systems Commmand include the Aeronautical Systems Division, Wright-Patterson AFB, OH, and the Electronic Systems Division, Hanscom AFB, MA.

7. (U) PROJECTS LESS THEN $10 MILLION IN FY 1986:

A. Project: 1155, Electro-Optical Collection/Reconnaisance (COMPASS SEVEN). The COMPASS SEVEN project responds to requirements defined, documented, and maintained by the Defense Intelligence Agency (DIA). These requirements are currently contained in DDC-2600-741-79, Electro-Optical Signatures Measurement and Signature Data Requirements (MASDR) File. COMPASS SEVEN responds to selected requirements in the MASDR File by developing and deploying one-of-a-kind sensors to collect the data necessary for establishment of a unique data base. It also responds to special requirements of various intelligence agencies for unique sensors for special collection purposes and those requirements identified in Electronic Security Command's (ESC) Statement of Need (SON) 002-81, "Electro-Optical Collection Capability," dated 21 October 83 . The COMPASS SEVEN systems are normally classified and often coupled to special access programs. The COMPASS SEVEN project is critical to the identification of specifications and parameters of threat weapons systems that must be addressed in the development of new weapon systems and countermeasures. This is accomplished by using the COMPASS SEVEN systems to establish a scientific and technical (S&T) data base on threat systems and enemy research and development efforts. It is also an element in the overall means used to observe and evaluate an enemy's capabilities and intentions. The current COMPASS SEVEN projects are comprised of the following: (1) COMPASS ERA, a system integrating both

aircraft to provide a data base for missile development, assessment of aircraft performance, new identification techniques, and countermeasure designs; (2) COMPASS FOG, a system for off-axis detection and classification of high-energy laser sources. The system will provide the capability to collect the data necessary to assess threat capabilities and intent; (3) High Resolution Camera System, a manually operated

camera onboard RC-135 aircraft used to obtain high resolution photographs of intercepting aircraft. Data is used to assess capabilities of these aircraft and any improvements/modifications noted; (4) ECAM, a miniature electro-optical camera for special ground collection/observation to be used by national agencies; (5) MALIBAR, a project to upgrade a ground based telescope and (6) Laser sensor development, a project to develop on- and off-axis laser detectors. In FY 1984 development, fabrication, and testing of a laser detection device for special collection purposes was continued. Also an update of the sensor on the RC-135 was continued to include replacement of the system's acquisition radar. The laser detector underwent further development to increase the different types of lasers it can detect. A high resolution camera system carried onboard special collection airframe was updated to improve resolution and reliability and redeployed. An effort to develop a miniature electro-optical camera for special ground surveillance and collection purposes, started in FY 1983, advanced to system testing and initial trial deployment. In FY 1985 the laser detector will continue testing, several units will be fabricated for possible deployment. The miniature electro-optical camera final testing and deployment will commence. Research into on- and off-axis laser detection will continue. Project MALIBAR, a project will be brought into this program. Two proposed projects are to develop a pod for use on tactical aircraft which will and to develop an off-axis airborne laser detector for S&T data gathering missions. Studies to determine the feasibility and scope of these and other collection requirements will be conducted during FY 1985 with a planned development startup in FY 1986. In FY 1986, in addition to completing the refurbishment of the COMPASS ERA system and continuing COMPASS FOG development and fielding, several newer programs will be continued or initiated. Project MALIBAR will continue modifying the Malibar space telescope to enable it The project to pod mount a to be called COMPASS PAIR, will be initiated pending the results of the FY 1985 study. A new project to install COMPASS STREAM, will start with an initial objective of building low to medium power laser detectors. Additionally, a study will be initiated to determine the potential for developing directed energy weapons collection devices. Cost estimates for this project are considered Category III based on the latest update in November 1984. This is a continuing program. The future plans for COMPASS SEVEN include completion of the COMPASS FOG system and continuation of the other projects started in FY 1985 and FY 1986. In addition, studies will be conducted to identify follow-on development efforts to meet highest priority data base requirements addressed in the Defense Intelligence Agency (DIA) Measurement and Signal Date Requirements (MASDR) Files and intelligence agency unique requirements. The COMPASS SEVEN program is designed to react quickly as new weapon systems or development efforts are discovered or new collection opportunities become available. Since programs within this project are usually short term and respond to requirements as they become known, not all future efforts can be determined ahead of time.

B. (U) Project: 2704, Tactical Electronic Reconnaissance (TEREC). The requirement for TEREC is stated in Tactical Air Command (TAC) Required Operational Capability (ROC) 24-70, "Tactical Electronic Reconnaissance (TEREC) Sensor (S)," dated 4 September 1970. This project has developed and produced an Electronic Warfare Support Measures sensor which can detect, locate, identify, and report enemy radar emitters in near-real-time and gather parametric data on emitters for later evaluation. This information can be used by tactical commanders and aircrews for battlefield assessment, threat avoidance, cueing of other sensors and attack systems, or direct target attack. Three main subprojects were funded within this project. The first is the TEREC airborne sensor itself employed on RF-4C reconnaissance aircraft. The second is the incorporation of TEREC datalink receive and TEREC tape processing capability into the Imagery Interpretation segments of the Tactical Information Processing and Interpretation system. The third project developed a TEREC Remote Terminal (TRT) for individual tactical unit use. The TRT provides individual units with the identity and location of enemy radars in near-real-time. Current TEREC efforts are to determine the requirement for updates to handle the 1990s threat and encrypt the High Frequency (HF) radio data link relay capability. In FY 1984 the last of the twenty-four TEREC modified RF-4C's were delivered. In FY 1984 an update to increase capabilities against agile emitters and increase single pulse processing continued and a study was initiated to evaluate future hardware and software modifications. The FY 1985 and FY 1986 funds for the TEREC system are to be used for development of a HF radio encryption capability for use with the TEREC air-to-ground data link. This data link allows near-real-time transmission of the identity and location of threat radar transmitters acquired by the TEREC system. This information is then used for route planning, threat attack, and threat avoidance. The National Security Agency (NSA) has ruled that the TEREC data link has to be encrypted. The Ultra High Frequency radio link is already encrypted and provides line-of-sight relay. However, for beyond line-of-sight transmission the HF radio needs to be used. Cost estimates for this project fall under the planning or Category IV criteria and are based on an estimate in August 1984. This is a continuing program. In FY 1987 a major hardware and software update, based on the FY 1984 study, will be initiated which will increase frequency coverage and processing speed and give the TEREC system capability against the newly fielded exotic radars. In the upgrade, as much of the existing system will be retained as possible and components from other systems will be used, if practical, to reduce both development and production costs.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64715F
DOD Mission Area: #205 - Physical Security Systems

Title: DOD Physical Security Equipment-Exterior
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		14,851	17,562*	15,733	19,581	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the full-scale development of the Department of Defense Base and Installation Security System, a standardized set of components, interfaces, and methodology for creation of exterior physical security systems, by accomplishing full-scale development tasks in three functional areas: detection, command and control, and imaging. A Department of Defense need exists for a family of standardized modular equipment, which can be integrated into system configurations to provide a level of security in consonance with the deployment mode, threat level, and sensitivity of the asset being protected. The resulting security equipment increases the capability of the security forces to detect and intercept terrorists and permits increased mobility of the forces for better utilization of existing manpower.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	14,969	12,562	13,214		Continuing	N/A
Other Procurement (PE 27589F) (formerly PE 27596F)	3,600	35,238	60,937		Continuing	N/A

The FY 1985 other procurement decrease is a result of a Congressional reduction which will delay by one year procurement of the improved buried line sensor for northern tier priority A nuclear resource locations. The FY 1986 other procurement reduction reflects a realignment of this program within the overall Air Force program and will delay the mobile individual resource protection sensor by an additional year. The increase in FY 1986 RDT&E funding reflects a greater emphasis by DOD in physical security. The intrusion detection sensor development efforts for waterside security and dispersed operations as well as sensors to protect against airborne threats will be accelerated.

*In addition to the $12,562 thousand requested, $5,000 thousand is provided for upgrading waterside security at Kings Bay, GA, Bangor, WA, and Norfolk, VA.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Other Procurement (PE 27589F)(PE 27596F)	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Funds	3,600	22,838	33,380	12,682	Continuing	N/A
Quantities	Not Applicable					

5. (U) RELATED ACTIVITIES: Advanced development tasks including equipment prototypes, development of technology base, and development testing are accomplished under Program Element 63714F, Department of Defense Physical Security Equipment-Exterior (Advanced Development). Procurement of physical security equipment is accomplished using Other Procurement-Air Force funding under Program Element 27589F, Base Physical Security Systems. The Base and Installation Security System equipment will be designed for interoperability with the Army interior security system (facility intrusion detection system) and the Army tactical sensor system (remotely monitored battlefield sensor system). Management oversight of the physical security equipment program is provided by the Department of Defense Physical Security Equipment Action Group with the Chairperson residing in the Office of the Under Secretary of Defense for Research and Engineering.

6. (U) WORKED PERFORMED BY: This program is managed by the Physical Security Systems Directorate, Electronic Systems Division, Hanscom AFB, MA. Department of Defense agencies performing development tasks are: Rome Air Development Center, Griffiss AFB, NY; Army Mobility Equipment Research and Development Command and Army Night Vision Laboratory, Fort Belvoir, VA; Army Waterways Experimental Station, Vicksburg, MS; Naval Ocean Systems Center, San Diego, CA; and the Naval Coastal Systems Center, Panama City, FL. In addition to these Defense agencies, the Department of Energy/Sandia Laboratories, Albuquerque, NM, performs engineering development tasks and the Analytical Systems Engineering Corporation, Bedford, MA, assists in the system engineering support and integration task.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: PE 64715F, DOD Physical Security Equipment-Exterior

A. (U) Project Description: This program responds to Secretary of Defense direction contained in Department of Defense Directive 3224.3, 1 Dec 1976, which designates the Air Force as executive agency for the development of standardized exterior physical security equipment and systems for the protection of bases and installations. This program will provide pre-production equipment and subsystems, and through test and evaluation, production specifications for the Base and Installation Security System equipment for the four Services. The engineering development tasks consist of optimization of the overall system configuration through conduct of component, subsystem, and system testing, and preparation of production specifications. The total Base and Installation Security System objectives are to provide a capability for high level security, against all threat levels, for resources in the three deployment modes: permanent, semipermanent, and mobile. Facilities and developments of other Services, government agencies, and commercial industries will be used to the maximum to insure that duplication of effort is avoided.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Security systems to protect open aircraft shelters and closed aircraft shelters completed full-scale development and are being deployed. The permanent individual resource protection sensor completed development and testing and is scheduled for deployment.

(2) (U) FY 1985 Program: The program provides for continued full-scale development of the Magnetic Intrusion Line Sensor (MILES) signal processor (AN/GSS-28), long ported coaxial sensor, and video storage system. The MILES processor replaces the existing alarm unit which is used with buried cables. The long ported coaxial system is an advanced buried cable for use in long perimeter applications. The video storage system is designed to store television images of intrusion attempts when more than one attempt is made. In addition to these efforts, engineering development for the Waterborne Intrusion Detection System (WIDS), for use in securing perimeters where water boundaries are involved; the foliage penetration radar, for use in protecting assets that are employed in a dispersed mode; and the Radar Airborne Intrusion Detection System (RAIDS) for use in providing an intrusion detection capability against aerial threats, will be initiated. The development of the Scope Shield Communication System, to provide a narrow band mobile secure voice communication capability, will also be continued in FY 1985. The additional funds that were added for waterside security will be used accelerate the waterside security development program and provide for demonstration project at Kings Bay, GA, Bangor, WA, and the shipyard at Norfolk, VA.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full-scale development of the WIDS, the foliage penetration radar, the RAIDS, and the Scope Shield Communication System will continue through FY 1986. Development of the video storage system will also continue in FY 1986. Cost estimates are based on inputs from various government agencies performing these development efforts which were updated in September 1984.

(4) (U) Program to Completion: This program will provide a family of modular electronic equipment, capable of being integrated in various system configurations to meet Department of Defense and Service requirements for space physical security. As requirements for exterior physical security are validated, development tasks will be assigned to the Air Force by the Under Secretary of Defense for Research and Engineering to satisfy the requirement. This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64724F
DOD Mission Area: #372 - Escort, Stand-off, and Counter C^3

Title: Tactical C^3 Countermeasures
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		27,554	23,800	17,441	26,496	Continuing	N/A
2462	COMPASS CALL Development	12,576	10,309	17,341	22,962	Continuing	N/A
2677	C^3 Countermeasures Development	150	0	0	0	Continuing	N/A
2726	Electronic Combat Support	9,389	7,196	100	3,534	Continuing	N/A
2927	PAVE TIGER	5,439	1,008	*	*	0	25,000
3091	PAVE RUNNER	0	5,287	**	**	**	**

*Project terminated in FY 1985
**Program funding moved to PE 64232F, PAVE RUNNER

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To accomplish close air support, interdiction, and counter air missions, the Tactical Air Forces (TAF) require a command, control, and communications (C^3) countermeasures capability. Currently, the EC-130H stand-off jamming aircraft provides the capability to disrupt elements of the enemy defensive command, control and communications networks. With this capability, the TAF can isolate selected enemy units from their command and control to prevent these units from receiving target assignments and enemy aircraft from receiving control vectors. This program also provides for the engineering development of new C^3 countermeasures equipment, such as Comfy Kid and Comfy Fox, for tactical electronic combat applications.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	28,237	28,100	23,941		Continuing	N/A
AIRCRAFT PROCUREMENT	8,517	27,028	37,227		Continuing	N/A
OTHER PROCUREMENT	0	0	36,152		Continuing	N/A
MISSILE PROCUREMENT	48,197	38,872	0		4,683	115,952

FY 1985 DIFFERENCE: Congressional RDT&E reduction of $4.3 million. Previous Compass Call procurement value included costs other than those to support development efforts.

FY 1986 DIFFERENCE: RDT&E decrease due to transfer of funding for Pave Runner and Comfy Challenge and termination of Pave Tiger. Increased effort for Compass Call to develop countermeasures for evolving threat. Previous Compass Call procurement value included costs other than those to support development efforts. Electronic Combat Support funds zeroed due to termination of Comfy Challenge program.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
PE 27253F, COMPASS CALL						
Aircraft Procurement Funds*	31,200	20,606	19,253	8,335	Continuing	N/A
Modifications	28,300	19,062	17,810	7,711	Continuing	N/A
Initial modification spares	2,900	1,544	1,443	624	Continuing	N/A
Quantity (Includes various items)						

*Includes modifications and initial modification spares associated with development efforts

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
PE 28021F, Electronic Combat Support						
Other Procurement Funds	0	0	0	0	0	0
PE 27246F, PAVE TIGER						
Missile Procurement Funds	48,197	37,942	0	0	0	110,339
Quantities	-					

5. (U) RELATED ACTIVITIES: The Air Force production manager (Air Force Logistics Command) and development manager (Air Force Systems Command) for the EC-130H (Project 2462) operate with a joint agreement for interface and configuration control to ensure that new equipment can be incorporated into operational use. This program will build upon technology demonstrated in PE 63718F, Electronic Warfare Technology, and PE 63749F, C^3 Countermeasures Advance Systems. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics; and PE 63214N, Tactical C^3 Countermeasures. This program provides engineering development for PE 27253F, COMPASS CALL; and PE 28021F, Electronic Combat Support.

6. (U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH, manages the program to develop improvements to the EC-130H; Electronic Systems Division, Hanscom AFB, MA, manages the program to develop and acquire ground-based systems; Air Force Logistics Command, Wright-Patterson AFB, OH, manages the EC-130H modification program. The primary contractors performing work for this effort include: Lockheed Aircraft Services, Ontario, CA, (Project 2462); Sanders Associates, Nashua, NH, (Project 2462); and Magnavox, Fort Wayne, IN, (Project 2462).

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

Project: 2726, Electronic Combat Support: The Air Force C^3 countermeasures program includes requirements for both offensive actions against the enemy's C^3 links and nets and defensive actions to protect friendly C^3 systems. This project funds ground-based systems to provide both offensive and defensive capabilities on the friendly side of the line of conflict. Specific developments in this project include: systems to analyze the[ ](Comfy Fox); and development of advanced[ ]capabilities (Comfy Kid). In FY 1984, source selection and contract award for Comfy Challenge occurred early in the year. Based upon the Air Force and Army Chiefs' 22 May 1984 Memorandum of Agreement, the Air Force terminated Comfy Challenge efforts and transferred the firm fixed price contract to the Army; FY 1985 funds for this program are being transferred to the Army. The Army is merging Air Force requirements into the Air Defense Electronic Warfare System (ADEWS) program. In FY 1986, the program will be limited to mission support in preparation for Comfy Fox/Kid development efforts beginning in FY 1987. The cost estimates are Category IV based on experience of the Air Force Systems Command Project Office with current, similar development programs and are current as of January 1984.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2462, COMPASS CALL Development

A. Project Description: In FY 1979, the Air Force directed an EC-130H stand-off jammming platform to be integrated into a Defense-wide command, control, and communications (C^3) jamming capability. The airborne capability will complement both present and future ground and sea-based systems to provide the theater commander with a coordinated jamming capability. The EC-130H stand-off jamming platform initially used readily available equipment to provide a near-term baseline capability. Meanwhile, the portions of the C^3 countermeasures package that needed development proceeded in this project. This project provides engineering development of jammers to counter or disrupt[ ]within the enemy C^3 network. This project makes major improvements to the initial EC-130H installed equipment to make it more powerful and able to handle additional threats at one time. These pre-planned improvements are necessary to correct known deficiencies in the baseline aircraft and to keep the EC-130H current into the 1990s. All improvements to the aircraft will also be made to the mission simulator to provide realistic mission-aircrew training.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Critical Design Review for the Project 34 subsystem was completed. The first six High Band One production units were delivered. This constitutes six of a total buy of eighteen units. The first Signal Location Preproduction Prototype subsystem was delivered and development efforts began to incorporate this capability into the simulator. The Compass Call Mission Simulator was delivered for training at Davis-Monthan AFB, AZ. Engineering development to counter new threats continued.

Program Element: #64724F Title: Tactical C^3 Countermeasures
DOD Mission Area: #372 - Escort, Stand-off, and Counter C^3 Budget Activity: #4 - Tactical Programs

(2) FY 1985 Program: The engineering development to counter a new threat will continue along with the definition phase of a countermeasure to an[ ] Incorporation of the signal location subsystem update to the mission simulator will continue.

(3) FY 1986 Planned Program and Basis for FY 1986 Request: Enhancements to the system will enable Compass Call to target[ ]to air resources. Jamming power and reliability improvements will commence. Development efforts to counter an increased number of threats will begin. Incorporation of the signal location updates will conclude, and inclusion of this capability into the mission support facility will occur. Since the late 1970's when Compass Call was developed using off-the-shelf equipment and technology, the EC-130H has demonstrated its utility in various exercises as an important and viable countermeasure to command and control systems. On-going pre-planned development efforts are a direct result of the development and procurement strategy that fielded this much needed C^3CM capability and the threat[ ] Development efforts for specific[ ]are special access. The cost estimates are Category III based primarily on current contracts and the Air Force Systems Command Project Office experience with current, similar development programs and are as of September 1984.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64725F
DOD Mission Area: #344 - Tactical Command and Control

Title: Combat Identification Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		23,485	16,046	13,164	30,226	Continuing	N/A
2597	Noncooperative Identification Subsystems	13,253	11,983	12,164	22,485	Continuing	N/A
2598	Cooperative Identification Systems	0	1,863	0	3,541	Continuing	N/A
2751	Indirect Identification Subsystems	1,800	2,200	1,000	4,200	Continuing	N/A
2778	Tactical Air Identification	8,432	0	0	0	0	29,838

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program element is to accomplish engineering development of systems that will provide reliable long-range identification of airborne targets in both all-weather and hostile electromagnetic countermeasures environments. This program is necessary because the numerical superiority and increasing capability of the projected threat demands that we be capable of engaging the enemy at long ranges with our beyond visual range weapons. The long-range, high confidence identification which is a prerequisite for such engagements

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	23,645	16,046	31,454		Continuing	N/A

(U) Reduction of $18 Million in FY 1986 is due to an adjustment in the Air Force's share of the Mark XV programs's funding requirements and the repricing of requirements. Project 2597 was increased $3.2M from FY 85 to support increased effort in Non Cooperative Identification programs. Project 2598 was reduced $18.7M to reflect the adjusted AF share of the Mark XV program (the AF share is in PE 63742F, Combat Identification Technology). Project 2751 was reduced $2.5M to reflect repriced requirements.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable

5. (U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Advanced Identification Techniques; PE 63706A, Identification Friend or Foe (IFF) Developments; PE 63742F, Combat Identification Technology; PE 64211N, Air Traffic Control Radar Beacon System/ Mark XII; and PE 64709A, IFF Equipment. Coordination and integration of the various activities under these program elements are accomplished through the Air Force led Tri-Service, Combat Identification System Program.

6. (U) WORK PERFORMED BY: The overall program is managed by the Tri-Service, Combat Identification System Program Office (CISPO) at the Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson Air Force Base, OH. The program office receives support from the Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson Air Force Base, OH and other offices within the Aeronautical Systems Divsion. Support is also provided by the Electronic Systems Division, Air Force Systems Command, Hanscom Air Force Base, MA; the MITRE Corporation, Bedford, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Additionally, the following contractors are engaged in work under this program: General Dynamics, Fort Worth, TX (project 2597 and 2751); Hughes Aircraft Co., Los Angeles, CA (project 2597); and Westinghouse Electric Corp., Baltimore, MD (projects 2597 and 2751); Hughes Aircraft Co., St Louis, MO (project 2597); Watkins-Johnson Corp., Palo Alto, CA (project 2597).

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

Project: 2751 Indirect Identification Subsystem. Reliable means of identifying enemy weapon systems at distances that exceed their lethal range is needed to allow our forces to limit their exposure to enemy weapons while still taking advantage of our own weapons' capabilities and to prevent fratricide. This project involves the development and demonstration of techniques to use existing sensor, processing and communications systems to collect, correlate and disseminate identification information from a variety of command and control elements to the weapons systems users. Initial efforts will use automatic data processing and displays coupled with limited electronic support measures data to demonstrate the feasibility of using this type of data in improving the overall identification process. In FY 1984, contractors completed the design and fabrication of the hardware for the electronic support measure sensor and identification processor. Software coding and check out was completed. Initial check out of the processor and sensor started at the contractor facilities. During FY 1985, contractors will finish check out of the equipment and conduct acceptance testing. The equipment will be shipped to Eglin AFB, FL, for demonstration testing

with airborne and ground based sensors and weapons platforms. In June 1985 the equipment will be shipped to Germany to conduct a European demonstration that will run through the end of the fiscal year. The purpose of the demonstration is to show the utility of automating the ID function which will allow improved accuracy, increased confidence in the ID declaration, and more timely response to unknowns. This will allow commanders to optimize weapon/target matching, permit the use of beyond visual range weapons at optimum range, and enhance survivability of aircrews through timely warnings. The FY 1986 program for the Indirect Subsystem will allow for shipment of the equipment back to the US after the European demonstration, storage of the equipment, and limited program office activities to define the follow-on phase of the program. The program office will analyze the demonstration results, prepare engineering change proposals (ECP's) as necessary and plan and budget for full scale development of the system. After FY 1986, the program will define and incorporate ECP's resulting from the demonstrations and engineering analysis. If the Tactical Air Command defines a requirement for incorporation of the system in the Command and Control network, additional funding would be required to do a full scale engineering development of the system and procure the equipment. Budget estimate confidence level is IV. Last revision was December 1983.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2597, Noncooperative Identification Subsystems

A. Project Description: Beyond visual range identification of airborne targets is

several complementary cooperative and noncooperative identification techniques as well as their integration are being developed under the Air Force led, Tri-Service Combat Identification System Program. This project accomplishes the engineering development of the most promising methods for noncooperative target identification. Primary emphasis is on techniques that can be applied to the F-15 and F-16 aircraft during the mid-1980s. Included in these techniques are radar algorithms such as the Dual Mode Recognition technique which

Another technique using radio frequency emissions from the target aircraft to perform long-range, adverse weather identification passively is being investigated. This project will also develop the capabilities to integrate and correlate identification information from multiple sources onboard the weapon system. Also, noncooperative identification technology is being applied to adapt electronic support measures equipment to support the near-term demonstration of improved indirect identification capabilities and future architecture implementation of the indirect capabilities into the Tactical Air Control System.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The FY 1984 program pursued the continued engineering development and demonstration of a potential generic passive Radio Frequency ID (RFID) sensor for application to the F-15 and F-16.

Multi-Source Integration (MSI) capability was transitioned from laboratory effort to the F-15 SPO through the award of a MSI implementation study that defined the engineering changes needed in the F-15 central computer, controls and displays to incorporate this algorithm. Continued brassboard development of a new advanced Electronic Warfare Warning System (EWWS) was pursued with some limited flight testing occurring in the spring of 1984. The indirect Subsystem (ISS) Demonstration continued engineeering development and finalized plans for their CONUS and European demonstrations starting in FY 1985. The miniaturized Mark XII system for the F-16 described in the 1985 RDT&E Descriptive Summary is now being managed and funded by the F-16 Program.

(2) (U) FY 1985 Program: In FY 1985, the Combat Identification System Program Office (CISPO) will complete the transition of the MSI algorithm to the F-15 SPO for full scale development and initiate transition planning for the F-16. This will involve the award of another MSI implementation study that will address F-16 weapon system peculiar requirements while maintaining a common MSI algorithm approach. Full Scale Development of a common passive RFID sensor will commence in late FY 1985 following a decision as to which one of several concepts will be pursued. The ISS demonstration in the CONUS and Europe will commence. (See project 2751)

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FSD of a common passive RFID sensor will continue with applications to the F-15 and F-16. F-16 MSI implementation study activities will continue with FSD to initiate in late FY 1986 after transition to the F-16 SPO. Initial engineering development capabilities will be started for application to the Advanced Tactical Fighter (ATF). An engineering development contract for an advanced Dual Mode Recognition (DMR) algorithm which will potentially increase ID ranges, provide ECCM capabilities and provide rear aspect and track-while-scan DMR capabilities will start. Budget estimate confidence level is IV. Last revision was August 1984.

(4) (U) Program to Completion: ATF MSI implementation study work will be completed and transitioned to the ATF SPO for integration into the ATF. The advanced DMR algorithm will be developed, tested and baselined for integration into the F-15, F-16 and ATF (if applicable). The passive RFID sensor will conclude development and testing and enter production for application to the F-15 and F-16 (and ATF if applicable). Initial engineering development of an advanced EWWS subsystem will be started in FY 1990. Upgrade/advanced development of the MSI algorithm will commence in FY 1989. This project is a continuing one, designed to take laboratory efforts in the noncooperative identification area, determine if they have generic application either in the Air Force alone or across the services, and develop them to the point where they can transition to a particular aircraft program office for actual production incorporation/retrofit.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) European Theater Demonstration of Improved Indirect Identification Capabilities	*(March 1985) June 1985

(2)	(U)	Management of Multi-Source Integration Development for F-15 undertaken by F-15 Program Office	FY 1984
(3)	(U)	Multi-Source Integration Study for F-16 Starts	March 1985
(4)	(U)	Complete Preliminary Design Assessments of Passive Radio Frequency Identification (RFID) Techniques	September 1985
(5)	(U)	Begin Development of Common RFID System	*(1984) September 1985

* Date presented in Fiscal Year 1985 Descriptive Summaries

(U) EXPLANATION OF MILESTONE CHANGES

(1) European demonstration slipped three months to reflect slip in contractor delivery dates of demonstration equipment.
(5) Date in FY 1985 Descriptive Summary was for a system unique to the F-15. New date reflects development of a common system with application to more than one aircraft. The year slip is due to results of other programs and studies not being available until that time.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64733F
DOD Mission Area: #224 - Defense Suppression

Title: Surface Defense Suppression
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		9,405	17,000	54,980	50,521	36,512	355,691*
2147	Imaging Infrared Seeker Integration	1,032				0	41,340
3006	Standoff Attack GBU-15 P^3I	8,373	17,000	54,980	50,521	36,512	167,386

*Includes funds for projects completed prior to FY 1984.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The GBU-15 is a Modular Guided Weapon System consisting of a 2000 lb unitary warhead, airfoil group, television (TV) and imaging infrared (IIR) seeker with data link for weapon control. It is designed to destroy high value point targets and enemy defense sites. System performance provides high terminal accuracy through man-in-the-loop weapon control from launch to impact. The GBU-15 with TV seeker is in production. The IIR seeker variant is in Initial Operational Test and Evaluation (IOT&E). The Preplanned Product Improvement (P^3I)program was initiated to provide a continuing effort to match improving enemy air defense systems with an air-to-surface system which provides highly accurate, medium standoff weapons for use against high value targets. The P^3I initiative develops and tests medium standoff range powered GBU-15s (AGM-130s) with a unitary warhead and with the SUU-54 dispenser loaded with submunitions. The guidance system for all AGM-130s will remain the TV/IIR seeker and data link. An improvement to the GBU-15 data link is planned to ensure accurate weapon system operation, both GBU-15 and AGM-130, in current and projected hostile environments. Weapon system support equipment will be developed for improved efficiency and mobility.

Program Element: #64733F
DOD Mission Area: #224 - Defense Suppression

Title: Surface Defense Suppression
Budget Activity: #4 - Tactical Programs

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ IN THOUSANDS)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	9,405	24,533	18,396		0	239,607
Other Procurement (PE #28030F)	60,216	127,269	156,934		146,060	651,673
Missile Procurement (PE #27165)			50,071		TBD	TBD

- Reduced FY 1985 RDT&E is due to nonprejudicial Congressional cut.
- Increased RDT&E in FY 1986 and Total Estimated Cost is due to the addition of an AGM-130 variant for runway attack, the improved data link development and the upgrade of the AGM-130/GBU-15 support equipment.
- Reduced procurement of GBU-15 weapons is due to higher priorities and will be made up through AGM-130 procurement.

4. (U) OTHER APPROPRIATION FUNDS: ($ IN THOUSANDS)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement (AGM-130):						
Funds			48,500	53,259	TBD	TBD
Quantities			97	100	TBD	TBD
Other Procurement (GBU-15):						
Funds	60,216	127,269	127,894	115,527	13,030	605,130
Quantities	345	635	715	650	60	3,173

5. (U) RELATED ACTIVITIES: Related and supporting efforts are pursued in Program Element (PE) 64604F, Submunitions, which develops the submunitions, supports the SUU-54 dispenser variant of the AGM-130 through development of a dispenser ejection subsystem and integrates submunitions into the dispenser.

6. (U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command (AFSC), Andrews AFB MD, and Armament Division (AD), Eglin AFB, FL. Major contractors are Rockwell International (prime contractor), Duluth, GA and Hughes Aircraft Co (data link contractor), Culver City/Canoga Park, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project 3006, Standoff Attack GBU-15 Preplanned Product Improvement (P^3I):

A. (U) Project Description: Develops and tests a medium standoff range powered GBU-15 (AGM-130). This is a product improvement to the GBU-15 currently in production. The guidance system for the AGM-130 will remain the television/imaging infrared (TV/IIR) seeker and data link. Two variants are being developed: AGM-130A, with a 2000 lb unitary warhead (MK-84) and AGM-130B, a SUU-54 dispenser loaded with the Boosted Kinetic Energy Penetrator (BKEP) and mines. An upgrade to the current GBU-15 data link will be developed to ensure total system performance in current and projected threat environments. Improved support equipment will be developed to provide increased efficiency and mobility and to account for weapon system operational differences between the AGM-130 and GBU-15.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Full scale development and system design were initiated.

(2) (U) FY 1985 Program: Continue motor qualification and integration with the unitary warhead. Continue fabrication of the AGM-130A for test and initiate Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E). Continue design and integration of the system autopilot and radar altimeter. Initiate design studies and trade-off analysis for the AGM-130 system integration on the F-15/F-16 aircraft and for the development of quick reaction, mobile support equipment. Initiate design of SUU-54 dispenser unique integration into the AGM-130 guidance, control and airfoil modules. Initiate design studies for integration and operation of BKEP and mines into the SUU-54 in preparation for AGM-130B Full Scale Development (FSD) in FY 1986. Initiate procurement activities for the development of an improved data link for man-in-the-loop control of both the GBU-15 and AGM-130 systems. Investigate the potential for integrating the 2000 lb penetrating warhead into the AGM-130 family.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Complete Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E), motor qualification, system integration and preparation for AGM-130A production. Assuming a favorable production decision, initiate production of the AGM-130A. Initiate full scale development (FSD) of the improved data link at the earliest possible time. The data link is the key to successful weapon system operation and high terminal accuracy. The improved data link will include advanced anti-jam techniques to ensure weapon system man-in-the-loop operation to target impact. Operational compatibility with the

current GBU-15 data link will be designed into the improved data link. Early augmentation into the inventory will limit the number of existing data links in inventory and will match AGM-130 rate production with improved data link production. Initiate Full Scale Development (FSD) of an updated support equipment effort. The support equipment design will permit faster weapon system assembly and checkout, improved support equipment reliability and maintainability, and greater support equipment mobility through smaller size and modular construction. Initiate FSD of the AGM-130B (SUU-54 dispenser loaded with Boosted Kinetic Energy Penetrators (BKEP) and mines). The AGM-130B is a high priority effort for a standoff weapon to deny enemy use of airfield runways at the very start of any conflict. Demonstration of dispensing technique, submunition ground pattern and guidance module algorithms will be accomplished. Continue the 2000 lb penetrating warhead integration activities. Cost estimates are based on past GBU-15 development/production and are Category IV estimates.

(4) (U) Program to Completion: Complete development and test of the AGM-130B, improved data link and support equipment. Assuming a favorable production decision, initiate production of the AGM-130B, improved data link and support equipment.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	AGM-130A FSD Start	7 Sep 1984*
(2)	(U)	AGM-130A Critical Design Review	3Q FY 1985
(3)	(U)	AGM-130A DT&E/IOT&E Start	4Q FY 1985
(4)	(U)	AGM-130B FSD Start	1Q FY 1986
(5)	(U)	Improved Data Link FSD Start	1Q FY 1986
(6)	(U)	AGM-130A Production Decision	3Q FY 1986
(7)	(U)	Support Equipment FSD Start	3Q FY 1986
(8)	(U)	Data Link Production Decision	4Q FY 1987
(9)	(U)	Support Equipment Procurement	2Q FY 1988
(10)	(U)	AGM-130B Production Decision	3Q FY 1988

* (U) FSD delayed due to unexpectedly long negotiations

Budget Activity: 4, Tactical Programs
Program Element: 64733F, Surface Defense Suppression

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The AGM-130 is a product improvement to the modular guided glide bomb, GBU-15. The AGM-130 will consist of the basic GBU-15 with a propulsion system for increased standoff range and a variety of weapon payloads, both unitary and submunition dispenser, for increased tactical flexibility and expanded mission capability. The AGM-130 Full Scale Development (FSD) program consists of developing an AGM-130A with a MK-84 (2000 lb) unitary warhead. One other variant is planned for FSD start in FY 1986: the AGM-130B with a SUU-54 dispenser loaded with Boosted Kinetic Energy Penetrator (BKEP) submunitions and mines. Because of the similarities with the GBU-15, the AGM-130 testing will be a combined DT&E/initial operational test and evaluation (IOT&E) as stated in the Operational Test and Evaluation section of this report.

(U) The GBU-15 glide weapon consists of guidance, control and airfoil modules which are integrated with the MK-84 unitary warhead. Guidance is provided by either a television (TV) or imaging infrared (IIR) seeker with data link control. The GBU-15/TV is in production having successfully completed Follow-on Operational Test and Evaluation (FOT&E) on 17 Nov 83 with 16 direct hits out of 18 launches. One hundred and eighteen F-4E and 106 F-111F effective sorties were flown in support of FOT&E. The GBU-15/IIR is currently in IOT&E having completed a successful DT&E. Five launches were conducted in the IIR DT&E all of which were off an F-4E aircraft. Three of the five launches were successful. Of the two misses, one weapon overflew the target as a result of an accumulation of events involving data link video breakup, tactics and seeker limitations. The second miss resulted from a weapon computer dump caused by aircraft power transients. This problem was corrected by initiating the weapon battery power earlier in the launch sequence. Thirty-five F-4E and two F-111F effective captive flights were flown in support of DT&E.

(U) The development contractor for the GBU-15 and AGM-130 is Rockwell International Corp., Duluth, GA. Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD, and its subordinate organization, Armament Division, Eglin Air Force Base, FL.

2. (U) Operational Test and Evaluation (OT&E): AGM-130 initial testing will be accomplished under a combined DT&E/IOT&E concept. The Air Force Operational Test and Evaluation Center (AFOTEC) will take the lead in operational testing which will be conducted by a combined test team from AFOTEC and the 3246th Test Wing, Eglin AFB, Florida. Testing will consist of captive sorties as well as live launches and will concentrate on the following areas: operational effectiveness (mission effectiveness, survivability, interoperability with other systems) and operational suitability (reliability, supportability, maintainability). Operational effectiveness will be evaluated during approximately 120 captive missions and 17 actual-guided launches. Suitability data will be collected during the entire combined DT&E/IOT&E. Test sites include Eglin AFB, Florida; China Lake Test Facilities; Naval Weapons Center, California; and White Sands Missile Range, New Mexico. The AGM-130 is currently compatible with two aircraft, the F-4E aircraft modified with the ARN-101 navigation system, and the F-111F PAVE TACK equipped aircraft. Test data from

Budget Activity: 4, Tactical Programs
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previous GBU-15 tests will be used when appropriate. Scheduled start date is September 1985. The AGM-130A production decision will occur in 3Q FY 1986. Test completion is scheduled for 3Q FY 1986.

(U) The GBU-15/Imaging Infrared (IIR) is currently in IOT&E. We plan to launch 11 weapons off both F-4E and F-111F aircraft. To date, seven launches have occurred with five successes and two misses. Of the misses, one weapon hit the ground close to the target and bounced through it. The other miss was caused by a weapon system officer (WSO) error with switchology on the control panel. An analysis of the human factors is ongoing. One hundred and ten sorties are planned in support of IOT&E. Ninety have been accomplished to date.

3. System Characteristics:

Characteristics	Objective	Threshold	Demonstrated[1]
Maximum Mach			
Maximum Altitude (feet)			
Minimum Altitude (feet)			
Range (Nautical Mile) GBU-15			
AGM-130			
Accuracy (feet) (Circular Error Probable)			
Reliability (weapon hardware inflight)	.95	.90[3]	.95[4]

1 Demonstration of parameter maximum was not necessarily a test objective.
2 Data not specified in technical specifications.
3 Tactical Air Command goal for Initial Operational Test and Evaluation.
4 Demonstrated during Development Test & Evaluation/Initial Operational Test and Evaluation.
5 Demonstrated during Development Test and Evaluation program conducted by Air Force Systems Command.

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4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
GBU-15/Television (TV) FOT&E Completion	November 1983	November 1983	Very successful
GBU-15/Imaging Infrared (IIR) IOT&E Start	November 1983	April 1984	Delay caused in fixing DT&E problem

T&E Activity (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
GBU-15/IIR IOT&E Completion	September 1984	February 1985	Delay in starting IOT&E
AGM-130A DT&E/IOT&E Start	September 1985		
AGM-130A DT&E/IOT&E Completion	3Q FY 1986		

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64737F
DOD Mission Area: #371-Self-Protection

Title: Airborne Self-Protection Jammer (ASPJ)
Budget Activity: #4-Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		41,679	25,000	11,220	1,033	0	209,428
2712	ASPJ Common Development	23,765	9,305	3,882	0	0	120,542
2715	ALQ-131/CPMS Development/ Integration	5,737	650	0	0	0	25,161
2719	F-16/ASPJ Development/ Integration	12,177	15,045	7,338	1,033	0	63,725

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Airborne Self-Protection Jammer (ASPJ), designated the ALQ-165, is a joint Air Force/Navy engineering development program for an internally mounted electronic countermeasures (ECM) system. The ASPJ will provide self protection and increase the probability of aircraft survivability when various tactical aircraft (F-16, F-14, F/A-18, A-6E, and AV-8B) are confronted by modern, diversified, radar controlled weapon systems. Development of associated support equipment, alternate technology and aircraft integration are included in this program element. Also included is development of the Comprehensive Power Management System (CPMS) for the USAF ALQ-131 ECM Pod to be carried by those aircraft not programmed for ASPJ. Major component, subsystem and system development will continue through the full scale production decision. Engineering Development Model systems will undergo effectiveness, qualification, and reliability testing. These systems will also be used to prototype aircraft installations.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
(U) RDT&E	41,819	29,149	11,467		1,055	213,126

(U) FY 1985 decrease is the result of a Congressional denial of funds which has resulted in a realignment of funds within the remaining projects. FY 1986 decrease is inflation adjustment.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands). Not Applicable

5. (U) RELATED ACTIVITIES: This program is structured as a joint Navy/Air Force effort with Navy funds provided under PE 64226N, Advanced Self Protection Systems. It is the intent of this program to attain 100 percent commonality of the Airborne Self-Protection Jammer (ASPJ) system design for internal application and to equally share the total Group B cost of engineering development between the two Services. The Air Force and Navy joint development efforts were initiated during FY 1979. Air Force funds were provided under PE 64738F, Protective Systems, and PE 64739F, Tactical Protective Systems. In FY 1980 Air Force direction and funds for this effort were consolidated under PE 64737F, Airborne Self-Protection Jammer. The F-16 internal electronic countermeasures (IECM) efforts are directly related to PE 27133F, F-16 Squadrons. The ALR-74 Radar Warning Receiver program is being interfaced with the ALQ-165 to ensure compatibility.

6. (U) WORK PERFORMED BY: ASPJ development is managed by a joint Navy/Air Force Program Office at the Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. The Air Force unique portion of this program, integration of the Comprehensive Power Management System (CPMS) into the ALQ-131 and ASPJ into the F-16, is managed by the Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH with assistance from Air Force Logistics Command, Wright-Patterson AFB, OH. The ASPJ/CPMS Phase I design effort was accomplished by two competitive contractor teams. One team was Northrop Corporation, Rolling Meadows, IL and Sanders Associates, Nashua, NH. The second team was ITT, Nutley, NJ and Westinghouse Corporation, Baltimore, MD. The ITT/Westinghouse team was selected during FY 1981 to proceed into Phase II (full scale engineering development) to develop Engineering Development Models. Integration of ASPJ into the F-16 is being accomplished by General Dynamics, Fort Worth, TX.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2712, ASPJ Common Development. This project funds the Air Force's share of the joint Navy/Air Force common development of the ASPJ, ALQ-165. This development is required to increase Air Force and Navy tactical aircraft survivability and provide an enhanced probability of mission success. The Research, Development, Test and Evaluation effort leading to the ALQ-165 is required to develop advanced electronic countermeasure techniques for countering projected threats

Twelve ASPJ Engineering Development Models (EDM) will be used for system effectiveness evaluations, reliability testing, qualification testing and Initial Operational Test and Evaluation. For FY 1984, Phase II of ALQ-165 development continued, and delivery of the Engineering Development models began. The 1985 planned program will accomplish Developmental Testing and Evaluation to include military qualifications, safety of flight, reliability development testing, ground simulator, and flight testing. Successful completion of Development, Test and Evaluation will lead to a joint Navy Systems Acquisition Review Council/Air Force Systems Acquisition Review Council (NSARC/AFSARC) III A Limited Production Decision in FY 1986. For FY 1986 Initial Operational Test and Evaluation will be completed and Reliability Qualification Testing and support equipment, development and integration testing will be accomplished. Successful completion of this testing will lead to a joint NSARC/AFSARC III B Full Rate Production Decision in FY 1987. Cost estimates are Category I based on an independent cost estimate approved in July 1984.

B. Project 2715, ALQ-131/CPMS Development/Integration. This project adapts the receiver/processor portion of the ALQ-165/ASPJ to provide an enhanced power management capability (Comprehensive Power Management System/CPMS) for the ALQ-131 electronic countermeasures (ECM) pod. CPMS will have a capability to detect radars. ALQ-131 ECM pods will be used on aircraft not scheduled to be equipped with an internal ECM system, such as the A-7D, A-10, F/RF-4, F-16B/D, and F-15B/D. For FY 1984, initial delivery of CPMS prototypes began and integration with the ALQ-131 ECM pod started. The FY 1985 program will complete the integration of the CPMS into the ALQ-131 ECM pod, complete delivery of 6 prototype systems for testing, and discharge CPMS obligations on existing contracts. Ground simulation testing and flight testing previously planned cannot be accomplished due to the Congressional reductions in FY 1985 funding. The Air Force is currently procuring the Receiver/Processor (R/P) as a power management system for the 557 Block II ALQ-131 pods based on a production decision made in 1983. The CPMS development program was continued to maintain a competitive atmosphere between the CPMS and R/P contractors to provide the needed capability of a power management system, force the contractor to perform on schedule, and keep procurement costs down. With the funding reduction occurring during the last phases of the CPMS development program, CPMS can not be completed on its originally planned schedule which called for a production decision in 1985. With continued production of the R/P, 150 R/P's could be delivered by the time CPMS begins delivery. These factors are being considered in the Electronic Warfare Roadmap. The Electronic Warfare Roadmap, being prepared for submission to Congress, will address this issue in detail. The CPMS share of the combined F-16/F-18 ASPJ/CPMS test program costs have been reallocated to Projects 2712 and 2719 as appropriate.

C. (U) Project 2719, F-16 ASPJ Development/Integration. This project supports unique engineering required for the integration of the ASPJ into the F-16 aircraft. Prototype engineering efforts and installation and check out of the ASPJ in the F-16 was accomplished in FY 1984. The FY 1985 program will complete the test, analyze, and fix program and development testing. Operational testing will be initiated. The efforts will lead to a joint Navy Systems Acquisition Review Council/Air Force Systems Acquisition Review Council (NSARC/AFSARC) III A limited production decision. Operational Testing will be completed in FY 1986 followed by an NSARC/AFSARC III B Full Rate Production Decision. Cost estimates are Category I based on an independent cost estimate approved in July 1984.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64738F
DOD Mission Area: #371 - Self-Protection

Title: Protective Systems
Budget Activity: #4 - Tactical Programs

1. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		50,343	45,565	65,792	83,814	Continuing	N/A
1627	Simulation, Analysis and Evaluation	8,468	7,900	14,090	14,686	Continuing	N/A
2114	Antenna Test Range	1,900	1,900	2,055	2,056	Continuing	N/A
2683	Countermeasures	200	0	0	0	0	120,000
3829	Infrared and Optical Countermeasures	4,500	2,300	2,093	9,403	Continuing	N/A
5615	Strategic Protective Systems	28,375	26,100	39,530	39,360	Continuing	N/A
5616	F/FB-111 Protective Systems	6,900	7,365	8,024	18,309	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for: (1) the maintenance and update of computer threat simulations for evaluation and analysis of Electronic Warfare (EW) equipment; (2) maintenance and update of an antenna test range to support both ground and airborne evaluations of new EW antennas, including radiation patterns and antenna isolation measurements; (3) development of Infrared (IR), optical and equipment for strategic and tactical aircraft; (4) engineering development of new or improved Electronic Countermeasures (ECM) equipment such as the ALQ-172 for the B-52H, a countermeasures capability against the and countermeasures for strategic bomber aircraft; and (5) engineering development of ECM equipment to counter a Tail Warning System (TWS) and an improved dispenser system for F/FB-111 aircraft.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	48,468	48,565	52,239		Continuing	N/A

PE #: 64738F

(U) Project 1627: Increase in FY 1986 to fund required Air Force Electronic Warfare Evaluation Simulator (AFEWES) upgrades to support Electronic Countermeasures (ECM) equipment testing (+4.5 million).

Project 3829: Decrease in FY 1986 development program to fund higher precedence objectives (-7.2 million).

Project 5615: Increase in FY 1986 for development of improved countermeasures for strategic and tactical aircraft (+22.6 million).

Project 5616: Decrease in FY 1986 F/FB-111 Radar Warning Receiver (RWR) F/FB-111 Tail Warning System (TWS) update programs to fund higher precedence objectives (-6.3 million).

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The efforts in this program draw heavily on concepts and technology demonstrated in the advanced development Program Element (PE) 63718F, Electronic Warfare Technology and PE 63743F, Electro-Optical Warfare. Technology from other projects within this PE, PE 64739F, Tactical Protective Systems, PE 64326F, Strategic Conventional Standoff Capability, and other classified PEs are utilized to the maximum extent possible.

6. (U) WORK PERFORMED BY: The major contractors for Project 5615 are the Boeing Military Airplane Company, Wichita, Kansas; International Telephone and Telegraph Avionics Division, Nutley, New Jersey; EATON/AIL, Long Island, New York; and Motorola Government Electronics Division, Scottsdale, Arizona. The major contractor for Projects 1627 and 5616 is General Dynamics Corporation, Ft. Worth, Texas. There are ten additional contractors with a total contract value of approximately $21 million. The Air Force manager for Project 2114 is Air Force Systems Command, Electronic Systems Division, Rome Air Development Center, Griffiss Air Force Base, New York. The Air Force manager for all remaining projects is Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2114, Antenna Test Range. This project provides for the acquisition, maintenance and continuing update of a precision Electronic Warfare (EW) antenna test range employing reconditioned shells of actual USAF combat aircraft. Current aircraft shells available include F-4, F-111, A-10, F-15, F-16, and B-52 aircraft. The range is used during advanced and Full-Scale Development programs to test and evaluate new ECM antennas and antenna installations on board actual aircraft to determine radiation patterns. FY 1984 accomplishments included F-15 and F-16 aircraft shell procurement and installation. The Precision Antenna Measurement System (PAMS) was upgraded to enable more accurate antenna pattern measurements to be taken from inflight aircraft. Precision measurements were conducted for the ALR-74 RWR on F-16 and F/FB-111 aircraft. Work was initiated on the Real-Time Data Reduction project which will computerize

the antenna pattern measurement facility. In FY 1985, work will continue on the Real-Time Data Reduction project. [ ] instrumentation projects will be initiated and efforts will begin to certify the ranges to [ ] and ultimately to [ ] During the FY 1986 planned program, the Real-Time Data Reduction project will be completed, the [ ] instrumentation projects will continue, and work will be initiated on [ ] instrumentation for the Precision Antenna Measurement System (PAMS). System isolation and range reflection measurements will be taken at the Stockbridge, NY facility.

B. Project: 3829, Infrared and Optical Countermeasures. This project funds development of improved flares for all USAF aircraft and, because of dispenser commonality, will provide a flare usable by most NATO and other friendly air forces. Improved flares are required because [ ] The project will also develop [ ] detection and countermeasures devices for all USAF combat aircraft beginning in FY 1987. The FY 1984 program saw development efforts continue on [ ] flare for B-52 aircraft. Three contractors are competing in this program. All three contractors successfully completed wind tunnel testing of their respective flares in May 1984 and will prepare to enter flight testing in March 1985. Down-selection to one contractor should occur in September 1985. Development of a productionized version of the flare by the winning contractor will then begin, leading to a production decision in February 1986. Planning includes efforts to develop a [ ]

C. Project: 5616, F/FB-111 Protective Systems. This project funds FSD of countermeasures capabilities required for F/FB-111 aircraft. Soviet threat system improvements require that the F/FB-111 be updated with new or improved countermeasures systems. This project is developing a [ ] capability for the F/FB-111, which supports and is an integral part of the F/FB-111 Electronic Warfare (EW) update program funded in a classified program element. It also funds an improved dispenser system for accurate and optimum use of chaff and flares, and an improved Tail Warning System (TWS) for accurate detection of enemy Air-to-Air Missiles and Surface-to-Air Missiles. A feasibility analysis addressing the installation of the ALQ-156 TWS on the F/FB-111 was accomplished in FY 1984, and development and integration efforts were initiated to install the ALE-40 chaff/flare dispenser on the F/FB-111 as well. Development of a [ ] capability continued. Development and integration efforts were initiated on the Group A portion of the [ ] system. In FY 1985, engineering development will be initiated for a TWS to update the currently installed TWS which is [ ] Full Scale Development (FSD) efforts will continue on the ALE-40 dispenser program leading to a production decision in FY 1986. The [ ] program will continue with the system undergoing design/verification testing, qualification testing and antenna testing at Rome Air Development Center (RADC). The RADC efforts are defined under Project 2114. The FY 1986 plan has the TWS undergoing integration and flight testing leading to a production decision in FY 1987. The ALE-40 dispenser system development and integration will be completed and the production program will be initiated to install the ALE-40 on the F/FB-111 fleet. FSD efforts will continue on an improved countermeasures dispenser system. This effort is aimed at developing and producing an integrated dispenser system that will allow optimum use of chaff and flares and have commonality with other currently fielded systems. The [ ] system will complete integration, Initial Operational Test & Evaluation flight testing, and system kit proofing given a positive production decision.

Program Element: #64738F
DOD Mission Area: #371 - Self-Protection

Title: Protective Systems
Budget Activity: #4 - Tactical Programs

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 1627, Simulation, Analysis and Evaluation

A. Project Description: This project provides for development, fabrication and validation of laboratory simulations of [ ] for detailed development and evaluation of potential countermeasures systems and techniques. The two simulation facilities funded by this project are the Air Force Electronic Warfare Evaluation Simulator (AFEWES) and the Real-Time Electromagnetic Digitally-Controlled Analyzer and Processor (REDCAP). These facilities provide realistic laboratory simulations of [ ] to permit effective definition, design and evaluation of new/improved countermeasures equipment in precisely-controlled environments. This permits extensive testing before flight test at a fraction of flight test cost for similar efforts.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: The AFEWES completed design work on the [ ] simulation upgrades. Upgrades using updated intelligence data were performed on the [ ] simulations. Tests were conducted on the HAVE CHARCOAL countermeasures system, the Airborne Self-Protection Jammer (ASPJ) system, and the Comprehensive Power Management System. The U.S. Army conducted development testing of potential payloads on their remotely-piloted vehicles, and the Canadian Air Force conducted ALQ-162 countermeasures testing. The REDCAP facility continued work on a [ ] simulation.

(2) FY 1985 Program: The AFEWES will begin fabrication of the [ ] upgrades and installation of a ground clutter simulation. Work will be completed on the Pulse Doppler portion of the [ ] and work will begin on the [ ] mode simulation at the REDCAP. Planned testing includes the [ ] system being developed in Project 5615.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The AFEWES will complete activity on the [ ] simulations and the [ ] simulation capability. Fabrication efforts will begin on the [ ] simulations to support ALQ-161 and ASPJ countermeasures testing. The REDCAP will continue work on the [ ] simulation including the [ ] to support [ ] Electronic Countermeasures testing. The AFEWES had funds added in FY 1986 to accelerate work on [ ] simulators. The budget estimates are Confidence Level IV and are based on similar work that has been accomplished in the past. Both the AFEWES and REDCAP upgrades are sole source activities that take place in government-owned/contractor-operated facilities. The funding estimates are current as of 30 July 1984.

(4) (U) Program to Completion: This is a continuing program.

PE #: 64738F

C. (U) Major Milestones: Not Applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 5615. Strategic Protective Systems

A. Project Description: This project provides for development of new and improved Electronic Countermeasures (ECM) for strategic bombers. The continued Soviet emphasis on improvements in quantity and quality of their air defense [ ]systems requires provisions for improved self-protection countermeasures systems for strategic bombers. This project provides development funds for the ALQ-172 countermeasures system for B-52H aircraft, a Counter-[ ]program and[ ]countermeasures program which are developing[ ]capabilities.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Initial Operational Test & Evaluation of the ALQ-172 system was completed and a positive production decision was made in June 1984. The[ ]program completed initial simulator testing of brassboard systems in January 1984 with excellent results. The[ ]effort began in August 1984. Initial[ ]work consists of an integration study that will be completed in March 1985.

(2) FY 1985 Program: The ALQ-172 development effort will continue. Specific efforts will include Organizational-level Support Equipment development. Interface hardware for use between the ALQ-172 and the USM-464 Countermeasures Test Set will be fabricated and tested. All discrepancies discovered during the extensive ALQ-172 testing program, to include flight tests, Test-Analyze-Fix and Reliability/Qualification testing programs, will be incorporated into the final production configuration. The[ ]program will continue with simulator testing scheduled against those simulations at the Real-Time Electromagnetic Digitally-Controlled Analyzer and Processor facility as described in Project 1627.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The ALQ-172 countermeasures system development will continue. The primary efforts will include an update of the software to insert the latest intelligence threat assessment data into the system's Emitter Identification tables prior to fielding the system. Full Scale Development of the[ ]countermeasures program will continue. Flight test will be conducted followed by a down-selection to a single contractor to complete development leading to a production decision in the FY 1988 timeframe. The [ ]countermeasures development effort will continue with development and integration of both the Group A and Group B hardware for ground and flight testing. Fabrication of two prototype systems for integration into the host ECM system will be initiated. Antenna isolation, pattern measurements and ECM technique evaluations will be

accomplished. The funding estimate for the ALQ-172 program has a Confidence Level I.[ ]estimates currently have a Confidence Level IV. Both are technology demonstration programs. The funding estimates are current as of 30 July 1984.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64739F
DoD Mission Area: #371 - Self-Protection

Title: Tactical Protective Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		34,574	39,000	75,709	96,007	Continuing	N/A
2272	F-16 Protective Systems	15,153	20,500	38,516	36,917	Continuing	N/A
2273	Integrated Electronic Warfare System (INEWS)	3,182	3,059	16,342	24,794	Continuing	N/A
2274	Special Operations Aircraft Protective Systems	2,658	0	686	4,107	Continuing	N/A
2879	Area Reprogramming Capability	2,696	6,618	11,786	9,800	Continuing	N/A
3106	A-10 Protective Systems	200	200	866	5,978	Continuing	N/A
3107	Special Mission Aircraft Protective Systems	3,943	4,850	751	4,704	Continuing	N/A
5618	F-15 Protective Systems	6,742	3,773	6,762	9,707	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the engineering development of new and improved self-protection electronic warfare (EW) equipment for tactical strike, air superiority, airlift and reconnaissance aircraft. All projects in this Program Element are in response to: Tactical Air Forces (TAF) Required Operational Capability (ROC) 303-76, F-16 Air Combat Fighter, 28 December 1976; TAF ROC 9-68, Advanced Tactical Fighter for Aerial Combat, 1 February 1968; TAF Statement of Need (SON) 312-80, Optical Threat Acquisition and Cuing System, 10 October 1980; TAF SON 304-80, Tactical Self-Protection Electronic Warfare Systems, 9 May 1980; Strategic Air Command (SAC) SON 06-80, Rapid Reprogramming Capability, 3 June 1981; and Military Airlift Command (MAC) SONs 07-81, 08-81, 09-81, Defensive Systems for Airlift, Combat Rescue Helicopters, and Combat Rescue HC-130 aircraft, 8 September 1981; and MAC SON 05-83, Special Operations Combat Talon II Aircraft/Combat Talon Improvements, 21 January 1983.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	33,237	86,631	62,779		Continuing	N/A

The projects within this program element were restructured in FY 1984 to develop defensive suites tailored for specific weapons systems to improve economic efficiency and to improve the effectiveness of Electronic Warfare (EW) subsystems. The major programmatic change was to transfer infrared jammers and funding from Project 2272 (formerly Active Countermeasures) to the new Project 3107 for support of special mission aircraft,[ ] Other program and funding transfers to the appropriate host weapon systems were relatively minor (e.g., a pyrophoric flare moved from Project 2274 to new Project 3106, A-10 Protective Systems). Additionally, funds were reprogrammed from one project to another project within the Program Element (PE) in response to normal changes in project schedules and costing update exercises. The Congress reduced FY 1985 PE funding by $47,600. Funds were added in FY 1986 to accommodate a restructured ALQ-131 Electronic Countermeasures (ECM) pod upgrade program (SEEK RAM) and to accomplish new reliability and maintainability tasks for the Integrated Electronic Warfare System (INEWS, now Project 2273). EW equipment programs deferred by FY 1985 budget reductions (assuming additional FY 1986 funds) include: Project 2272, (originally $64,100) reduced $43,600 to $20,500 (start of ALQ-131 SEEK RAM full scale development (FSD) delayed until fourth quarter FY 1985); Project 2879, (originally $9,315) reduced $2,697 to $6,618 (independent verification and validation of Area Reprogramming Capability system software delayed until FY 1986) and Project 5618 (originally $5,107) reduced $1,334 to $3,773 (delays until FY 1986 modification of an F-15 test aircraft needed to support flight testing of F-15 Tactical EW Suite software updates).

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. RELATED ACTIVITIES: Project 2272, F-16 Protective Systems, monitors the Optical Threat Acquisition and Countermeasures system which began (and continues) as advanced development brassboard systems in PE 63743F, Project 2222, Advanced Electro-Optical Countermeasures for suitability as FSD (e.g., repackaging) candidates. Very High Speed Integrated Circuit technology developed in PE 63452F is applied to EW equipment (ALQ-131 ECM pod, ALR-69 Radar Warning Receiver (RWR)) also in Project 2272. Project 2273, INEWS, supports preliminary FSD of the INEWS. The INEWS program, formerly called the New Threat Warning System, began and continues as an advanced development program in PE 63718F, Project 2432, Warning and Power Management Systems and Technology. Development of the INEWS is a joint Air Force/Navy program formalize by a signed Memorandum of Agreement. INEWS will incorporate the PAVE PILLAR avionics architecture developed in PE 63253F, Advanced Systems. Project 2274, Special Operations Aircraft Protective Systems, investigates the near term use of laser threat warning technology which was refined in PE 63743F, Project 431G, Electro-optical Warfare through such advanced development efforts as the Detection of Laser Emitters, Detection of Laser, Radar, and Millimeter Waves and Advanced Laser Warning System technology programs. Project 2274 also analyzes the potential application of a millimeter wave (MMW) warning capability to tactical aircraft RWR,[ ] This MMW capability is to be developed with modular components (hardware and software) for common application to the F/FB/EF-111 and[ ]U.S. Navy aircraft. The RWR-unique interfaces and aircraft-unique integration efforts for this capability are to be developed for the Air Force in PE 64738F, Project 5616, F/FB-111 Protective Systems. U.S. Navy participation is addressed in a signed Memorandum of Agreement between Aeronautical Systems Division of Air Force Systems Command and the Naval Air Systems Command. Project 5618, F-15 Protective Systems, scales down and reconfigures the pyrophoric flare which is under development for the B-52, PE 64738F, Project 3829, Infrared and Optical Countermeasures. The tactical pyrophoric flare will provide self-protection for tactical

aircraft (F-15, F-16, F-4, F-111, A-7 and A-10) against modern infrared (IR) missiles while satisfying tactical aircraft countermeasures dispenser (CMD) (ALE-40/45/47) packaging constraints. (NOTE: The pyrophoric flare began advanc development in Program Element (PE) 63743F, Project 431G, Electro-Optical Warfare). Funding to procure equipment developed in PE 64739F is budgeted in the respective weapons system production funding lines.

6. (U) WORK PERFORMED BY: This PE is administered at the Aeronautical Systems Division, WrightPatterson Air Force Base, OH. Major contractors are Westinghouse Electric Corporation, Baltimore, MD, and Raytheon Corporation, Goleta, CA, (ALQ-131 electronic countermeasures (ECM) pod updates program and Integrated Electronic Warfare System (INEWS)); Northrop Corporation, Rolling Meadows, IL, (ALQ-135 Internal Countermeasures Set, INEWS and active IR countermeaures (IRCM)); Loral Electronic Systems, Yonkers, NY, (ALR-56C radar warning receiver (RWR), INEWS and Loral's Electro-Optical Systems Division in Pasadena, CA, for active IRCM); and Teledyne Systems Company, Northridge, CA, (Area Reprogramming Capability (ARC)). There are 23 additional contractors performing work costing a total of $73,074 thousands from FY 1986 through FY 1990 on other activities within the PE.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2274, Special Operations Aircraft Protective Systems: This project develops electronic warfare (EW) equipment which form the self-protection suites for AC-130, MC-130 (Combat Talon), HH-53 and other special operations aircraft. Most tasks within this project tailor available equipment (such as RWRs, IR jammers, chaff, flares and dispensers) or equipment under development in other projects within the PE (such as the ALE-47 and ARC system) for application to special operations aircraft. The unique, funded task within this project is to develop a near-term modular system to provide a millimeter wave (MMW) and laser threat warning capability for[ ]AC/MC-130 aircraft. A mid-term program is planned to provide this MMW/laser capability for AC/MC-130 aircraft when they become equipped with the[ ]RWR. The MMW/laser warning capability is particularly important to special operations aircraft due to the unique nature of the special operations mission and the high probability that these aircraft may be exposed to MMW/laser defense systems[ ] These MMW/laser warning efforts will begin in FY 1986. A request for proposal will be prepared and a contract awarded to initiate full scale development (FSD). MMW/laser warning development continues with integration and ground testing through December 1987; flight testing is planned for January 1988 to enable a November 1988 production decision.

B. Project: 3106, A-10 Protective Systems: This project develops EW equipment which form the self-protection suite for the A-10. Most tasks within this project tailor equipment developed in other projects in the PE for A-10 application (such as the ALQ-131 SEEK RAM ECM pod; MMW/Laser Warning; the ALE-47 CMD and the ARC system). The initial task within this project is to develop an effective expendable countermeasure to attacks from[ ]IR missiles. This expendable countermeasure is a metallic alloy pyrophoric flare which is being developed as an alternative to liquid fueled pyrophoric flares. (Smaller sized (one inch square) flares appropriate for the A-10 pose a significant technical challenge). Preliminary FSD of the A-10 metallic alloy pyrophoric flare to demonstrate concept feasibility began in FY 1984. Sixty test articles were procured, wind tunnel testing was conducted and static flight testing (using a Navy P-3 aircraft) was initiated. Preliminary FSD to demonstrate concept feasibility,

including static flight testing, will be completed in FY 1985. The FY 1986 planned program continues Full Scale Development of the metallic alloy pyrophoric flare. A critical design review will be held, and ground testing of a prototype flare will be completed. Flight testing of the prototype flare using an A-10 test aircraft will be accomplished, and modifications to the flare will be made to upgrade the flare to a pre-production configuration. The metallic alloy pyrophoric flare completes development and flight testing in August 1987, enabling a production decision by January 1988 and production deliveries starting February 1989. Tailoring the AC/MC-130 laser warning capability for A-10 application is to begin in FY 1987 and complete by FY 1990. Tailoring the F-16's ALE-47 integrated countermeasures dispenser for the A-10 application begins in FY 1988 and completes by FY 1990. Other A-10 self-protection tasks will be initiated as requirements are identified and funds become available.

C. Project: 3107, Special Mission Aircraft Protective Systems: This project develops Electronic Warfare (EW) equipment which form the self-protection suites for[ ]high value aircraft which are consistent with the[ ]environments in which these aircraft operate. Although there are ongoing study and analysis efforts to define the opportunities for using existing equipment (such as chaff and flare dispensers, radar warning receivers and radar jammers) to protect high value aircraft, the primary task within this project is to upgrade a[ ]missile jamming capability to counter[ ] An integral part of this IR jammer Quick Reaction Capability (QRC) effort is to expand coverage[ ]protection and to develop modulation techniques which will counter a greater number of surface-to-air[ ]missiles. IR jammer (HAVE CHARCOAL, QRC 82-03) prototype effectiveness and modulation technique refinement in the Air Force EW Evaluation Simulator (AFEWES) began in FY 1984. Upgrading the AFEWES for the current version of the[ ]missile and signature measurement of the candidate aircraft were completed. Contract efforts were initiated for procurement of one and a half ship sets of pre-production HAVE CHARCOAL systems from each of the three competitors. Preliminary design of a universal installation kit for the competing HAVE CHARCOAL equipment is underway. AFEWES testing, ground reliability/maintainability testing and flight testing of HAVE CHARCOAL equipment will be completed in FY 1985. A production request for proposal will be published and a source selection will start for the HAVE CHARCOAL QRC configured systems. Cross-correlation and validation of ground, AFEWES and airborne flight test results will continue in FY 1986 to define the growth potential of each candidate system and to form the basis for IR jammer upgrade tasks. Likewise, cross correlation and validation of aircraft ground IR signature measurements with airborne IR signature measurements will be performed to better define the impact of atmospheric phenomena on IR jammer performance. Reliability and maintainability testing of HAVE CHARCOAL systems will complete, and a program for logistics support will be initiated to assure the QRC systems are supportable in the long term. Complex modulation techniques and[ ]capabilities identified as feasible under QRC growth potential efforts will be further developed to satisfy E-3 IR jammer requirements and for retrofit into[ ]aircraft, with installation[ ]planned[ ] A program will be defined to further expand IR jammer capability to counter modern,[ ]IR missiles.

D. Project: 5618, F-15 Protective Systems: This project develops improvements and upgrades to the F-15's self-protection suite, the Tactical Electronic Warfare System (TEWS). The F-15 TEWS consists of the ALR-56 radar

warning receiver (RWR), the ALQ-135 internal countermeasures systems (ICS), the ALQ-128 Electronic Warfare Warning System (EWWS) and the ALE-45 countermeasures dispenser (CMD). Upgrade of the ALR-56 to the ALR-56C configuration, upgrade of the ALQ-135 to include Band III capability and a CMD interfaced with the RWR are required to provide the F-15 with systems to provide effective aircrew warning and countermeasures against the[ ]airborne threat and sophisticated surfaceto-air threats. These tasks constitute an ongoing program to develop self-protection capabilities which will permit the F-15 to accomplish its combat tasking in a technologically advanced, dense threat environment. In FY 1984, full scale devlopment (FSD) of the ALE-45 CMD, including flight testing, was completed; prototype models of the ALR-56C and ALQ-135 Update (Band III) systems were delivered; ground testing and component integration of these systems began. In FY 1985, ground testing and flight testing of the individual ALR-56C and ALQ-135 update systems will be completed and a full-up Tactical Electronic Warfare System integration effort will start. Production line F-15C/Ds will be equipped with ALE-45 CMD, ALR-56C and ALQ-135 Update installation kits. The FY 1986 planned program is to complete full-up ALR-56C and ALQ-135 Update hardware and software development, integration and testing, including productionizing of the prototype equipment (reliability and maintainability improvements, etc.). Efforts include ALR-56C and ALQ-135 software updates in response to threat changes which have occurred since the prototype systems were baselined. ALR-56C/ALQ-135 Update integration efforts will continue to optimize systems effectiveness. F-15 test aircraft will be modified to accommodate continuing software and hardware testing of production equipment. FSD of a pyrophoric flare to provide the F-15 protection against modern,[ ]infrared (IR) missiles will begin. Beyond FY 1986, software updates to the ALR-56, ALQ-135 and ALE-45 will continue in response to threat parameter changes. Development of[ ]countermeasures will begin. Reliability and maintainability improvements will be developed for the current ALQ-135 Band I/Band II systems. The ALE-45 CMD will be fully integrated with the ALQ-135 to improve TEWS effectiveness. F-15 pyrophoric flare development will complete.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2272, F-16 Protective Systems

A. Project Description: This project develops electronic warfare equipments which form the self-protection suite for the F-16. Tasks within the project develop upgrades to inventory ALQ-131 electronic countermeasures (ECM) pods to improve reliability, maintainability and performance to counter[ ]interceptors and advanced surface-to-air missile and anti-aircraft artillery systems; develops ECM pod and RWR reliability and producibility improvements through very high speed integrated circuit technology insertion; tailors the millimeter wave warning capability to be developed in Project 2274 for F-16 application; develops the automatic, threat adaptive ALE-47 CMD which is to be integrated with Airborne Self Protection Jammer (ASPJ)/ALR-74 RWR equipped F-16 C/D; develops pyrophoric flares to counter modern[ ]IR missiles; and develops an optical threat acquisition (or aircrew warning) and countermeasures system. Each of these tasks are to develop self-protection capabilities which will permit the F-16 to accomplish its combat tasking in a technologically sophisticated, dense threat environment.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The ALQ-131 Block III electronic countermeasures (ECM) pod (SEEK RAM) completed preliminary full scale development (FSD); preparation of a Request For Proposal (RFP) was completed. Preliminary Design Review (PDR) for ALQ-131 very high speed integrated circuit (VHSIC) technology insertion was completed successfully and component integration initiated. ALR-69 radar warning receiver (RWR) VHSIC technology advanced development began. PDR and Critical Design Review (CDR) of the ALE-47 countermeasures dispenser (CMD) were successfully completed.

(2) (U) FY 1985 Program: Source selection and contract award will initiate FSD of the ALQ-131 Block III ECM pod. A CDR and ground test of VHSIC components as applied to the ALQ-131 transmit control assemblies will be completed. FSD for VHSIC applications to the ALQ-131 Interface Control Module (ICM) will begin, and a PDR and CDR are scheduled to kick off the VHSIC/ALQ-131 ICM component integration effort. A PDR will be held for VHSIC application to the ALR-69 RWR and component integration will begin. Ground test of the ALE-47 CMD and F-16 integration begins.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 planned program continues ongoing efforts to field effective affordable self-protection for combat tasked F-16's; funds requested are essential to assure development and production milestones are met on time so F-16 production line incorporation and/or capability deployment schedules are not affected. FSD of the ALQ-131 SEEK RAM pod continues; CDR will complete and SEEK RAM pod fabrication and integration will begin. Integration and test of ALQ-131 VHSIC ICM components will be completed. Integration of VHSIC components into the ALR-69 RWR continues; a CDR will be held and component testing will be completed. FSD of a pyrophoric flare for the F-16 begins and a PDR will be held. ALE-47 CMD reliability and maintainability testing begins while F-16 integration continues; a development test and evaluation flight test on the F-16 will be conducted. Program costing was reviewed in June 1984; cost estimates are Category IV based on experience of the Air Force Systems Command Program Office with current, similar development programs.

(4) (U) Program to Completion: This is a continuing program to develop self-protection capabilities for the F-16 with production funds in weapon systems' lines. The ALQ-131 SEEK RAM development program continues through an April 1990 production decision, leading to first deliveries in October 1991. The F-16 pyrophoric flare should be ready for production in February 1990 and the ALE-47 CMD in October 1988. The optical threat acquisition and countermeasures system begins FSD in October 1987.

C. (U) Major Milestones: (Note: Milestones are presented only for the ALQ-131 SEEK RAM and ALE-47 CMD as these are major systems in and of themselves; the remaining tasks address supporting systems).

Milestones	Dates
(1) (U) ALE-47 Preliminary FSD Contract Award	September 1983
(2) (U) ALQ-131 SEEK RAM Preliminary FSD Contract Award	December 1983

		Milestones	Dates
(3)	(U)	ALE-47 Preliminary Design Review (PDR)	April 1984
(4)	(U)	ALQ-131 SEEK RAM PDR	June 1984
(5)	(U)	ALE-47 Critical Design Review (CDR)	July 1984
(6)	(U)	ALE-47 Component Testing	April 1985
(7)	(U)	ALE-47/F-16 Integration	June 1985
(8)	(U)	ALQ-131 SEEK RAM Full Scale Development Contract Award	September 1985
(9)	(U)	ALE-47/F-16 Development Test and Evaluation (DT&E) Flight Test	January 1986
(10)	(U)	ALQ-131 SEEK RAM CDR	June 1986
(11)	(U)	ALQ-131 SEEK RAM Fabrication and Integration	September 1986
(12)	(U)	ALE-47/F-16 Production Decision	January 1987
(13)	(U)	ALE-47/F-16 Initial Operational Test and Evaluation (IOT&E)	April 1987
(14)	(U)	ALQ-131 SEEK RAM Ground Testing	April 1988
(15)	(U)	ALQ-131 SEEK RAM DT&E/IOT&E Flight Test	September 1988
(16)	(U)	ALQ-131 SEEK RAM Limited Production Decision	April 1990

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2273, Integrated Electronic Warfare System (INEWS)

A. Project Description: INEWS is an Air Force (AF) led, joint AF/Navy program to develop the next generation airborne combat self-protection capability for advanced technology aircraft such as the Advanced Tactical Fighter and the Navy's Advanced Tactical Aircraft. INEWS is the defensive architecture,[ ] which will enable host aircraft to perform combat missions while operating in the technologically advanced, [ ] threat environment of the 1990s. This threat consists of airborne and surface based[ ] defense systems and the[ ] which links them together. The threat requires INEWS to provide aircrews timely and accurate threat warning and automatic application of optimum countermeasures such as in-band jamming and expendable countermeasures (chaff, flares, etc.) which are tailored to the specific mission requirement and threat environment[ ] Effective implementation of INEWS necessitates a defensive capability fully integrated with other aircraft sensors and avionics through and with an avionics architecture (such as PAVE PILLAR) to achieve total weapon system synergism. In recognition of the importance of the need to address adequately a response to the constantly escalating threat environment INEWS has been selected as a major system to be incorporated into the Defense Systems Acquisition Review Council process in FY 1986.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Integrated Electronic Warfare System (INEWS) Phase IA, Concept Definition Investigation (CDI), was initiated on 19 July 1984 with award of contracts to five teams (Sanders/General Electric, ITT/Litton, Hughes/Loral, Raytheon/Northrop, and TRW/Westinghouse).

(2) FY 1985 Program: INEWS Phase IA continues. During CDI, contractors will define and document the overall installed system performance requirements, develop system concepts[ ] assess the incremental contribution to weapon system survivability for each system concept, initiate a logistics program integral to the concept development effort, and prepare a draft statement of work to outline a preliminary full scale development (FSD) program.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 planned program continues Phase IA CDI to completion, which includes down selection from five to two contractor teams. Funds requested are essential to ensure that INEWS preliminary FSD commences on schedule so that an effective, affordable self-protection capability is developed in concert with the development of the host weapons systems (Advanced Tactical Fighter (ATF), Advanced Tactical Aircraft and other advanced technology aircraft). Specific tasks for FY 1986 include demonstration of individual, high risk elements (sensors, transmitters, computers, etc.) through laboratory hardware, emulation, modelling and analysis; validation of overall system concepts including identification of performance, integration, packaging and installation risks; performance measurement of installed equipment; and concept tradeoff analysis to refine the INEWS system based on updated threat information and aircraft characteristic/mission scenario information. Program costing for these risk reduction and system design refinement tasks was reviewed in June 1984; cost estimates are Category IV based on experience of the Air Force Systems Command Program Office with current, similar development programs.

(4) (U) Program to Completion: INEWS preliminary FSD continues through FY 1988 and completes with down selection from two teams to one contractor team in FY 1989. Actual FSD and sustaining engineering begins in FY 1989 and lasts through FY 1992, including flight testing. A timely INEWS production decision will be made in order to marry INEWS with the ATF production line.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) CDI Contract Award	July 1984
(2) (U) Complete Concept Definition	December 1985
(3) (U) Begin Preliminary FSD (Milestone I)	February 1986
(4) (U) Systems Design Review	March 1988
(5) (U) Complete Preliminary FSD	April 1989

Program Element: #64739F
DOD Mission Area: #371 - Self-Protection

Title: Tactical Protective Systems
Budget Activity: #4 - Tactical Programs

Milestones	Dates
(6) (U) Begin Full Scale Development (FSD) (Milestone II)	July 1989
(7) (U) Begin Flight Test	October 1991
(8) (U) Complete FSD	October 1992

10. (U) PROJECT OVER $10 MILLION IN FY 1986

(U) Project: 2879, Area Reprogramming Capability

A. Project Description: This project develops electronic warfare (EW) hardware which form the self-protection suite for the F-4. Most tasks within this project tailor available equipment (such as the ALQ-184 electronic countermeasures (ECM) pod) and equipment developed in other projects for F-4 applications. The primary task in this project provides for the development of an Area Reprogramming Capability (ARC). The purpose of the ARC is to provide the using commands, both in the Continental United States and in-theater, with the capability to respond rapidly to[ ] This will be done by[ ] in a wide range of ECM and radar warning receiver systems, using the ARC console. The ARC is a software intensive, computerized console that will allow the operators to assess the impact of new[ ] establish and select realistic reprogramming options for the[ ] software, test the options, and create and document the changes to the software program. The ARC program updates the existing manual system to achieve a more rapid and accurate response while using less highly skilled personnel in the reprogramming decision making process.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The ARC contract was awarded to Teledyne Systems Company, in February 1984. Hardware and software FSD efforts were initiated to design and fabricate four ARC systems that will support reprogramming of five types of Tactical Air Command/Strategic Air Command (SAC) reprogrammable EW systems. A System Requirements Review was held in April 1984 and was followed by a System Design Review in August 1984.

(2) (U) FY 1985 Program: ARC FSD, including hardware/software integration, will continue. Preliminary and Critical Design Reviews will be held to finalize prototype configurations. Efforts will also include a study to define the characteristics of a transportable, shelterized ARC system.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Hardware development for prototype ARC's will be completed. Interim software for the ALQ-161 will be delivered to SAC to support the B-1 Initial Operational Capability. System integration and system design tests will be conducted followed by Development Test and Evaluation of the prototype ARC for five reprogrammable EW systems. Preparations will be made to install the ARC systems at HQ SAC, Tactical Air Warfare Center, and Warner Robins Air Logistics Center. Category II cost estimates

for this program (November 1983) were developed using Aeronautical Systems Division price modeling techniques. The program was openly competed for the Phase I contract, which is a Cost Plus Incentive Fee contract.

(4) (U) Program to Completion: Development Test and Evaluation (DT&E) testing will be completed, followed by Initial Operational Test & Evaluation (IOT&E) testing. Continental United States Area Reprogramming Capability (ARC) systems (fixed sites) will be delivered for support of the initial five reprogrammable electronic warfare systems. A Phase II effort will be initiated to procure more fixed sites for Pacific Air Forces and United States Air Forces Europe to support the initial five electronic warfare systems in addition to ten follow-on reprogrammable electronic warfare systems. A production decision for deployable, sheltered ARC systems will be made in FY 1988.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Prototype ARC Contract Award	February 1984
(2)	(U)	Critical Design Review	June 1985
(3)	(U)	Software to support B-1 Initial Operational Capability	June 1986
(4)	(U)	DT&E Complete	March 1987
(5)	(U)	IOT&E Complete	July 1987
(6)	(U)	Follow-on ARC Decision	August 1987

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64740F
DOD Mission Area: #440 - Technical Integration/Study and Analyses

Title: Computer Resource Management Technology
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		6,197	9,358	14,011	14,408	Continuing	Not Applicable
2239	Computer Security Technology	1,656	1,814	1,739	1,700	Continuing	Not Applicable
2522	Requirements Analysis	1,200	1,240	1,500	1,600	Continuing	Not Applicable
2523	Management Control Technology	210	446	1,700	1,800	Continuing	Not Applicable
2524	Policy and Procedure Guidance	1,189	1,151	895	833	Continuing	Not Applicable
2526	Software Engineering Tools and Methods	942	1,001	2,170	2,173	Continuing	Not Applicable
2983	Logistics Information Management Support System (LIMSS)	1,000	3,706	6,507	6,302	Continuing	Not Applicable

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Air Force and Department of Defense studies have shown that the rapid increase in requirements for computer software diverts resources from other vital mission requirements. Increasing threat complexity has forced an increase in mission complexity and increased proliferation of digital computers and software. DOD computer costs are growing rapidly; this growth must be controlled. The program's goal is to apply technology in the system acquisition and support process to reduce software life cycle cost and to improve the quality of weapon system software. Consisting of some 40 different tasks, this program: exploits the results of advanced development programs; develops and applies techniques to reduce cost and increase reliability in complex automated defense systems; and provides users and system designers with software engineering and software management tools to specify, design, test and support automated defense systems. This program addresses identified deficiencies in: the use and control of high order languages; management and engineering approaches to computer software development; the use of requirement and cost analyses; and the application of comprehensive acquisition management procedures. This program funds the only research and development effort for Air Force multi-level computer security. This program is developing an information network that links existing and planned logistics/engineering systems into a totally integrated architecture. Cost estimates were derived by task breakout based on program office experience.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,297	12,358	15,454		Continuing	Not Applicable

- The FY 1985 reduction of $3.0 million was due to Congressional action.
- The FY 1986 change includes a reduction of $0.5 million due to higher priority requirements and a reduction of $0.943 million due to revised inflation estimates.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This Program Element (PE) supports and is responsive to the DOD Software Initiative and the DOD Ada Joint Program (PE 63226F, DOD Common Programming Language (Ada)). It is related to PE 63728F, Advanced Computer Technology and PE 27595F, Base Communications Tactical Air Forces. The Joint Logistics Commanders (JLC) effort is supported through this program. The Air Force's technology efforts and initiatives generally transition into this PE from PE 63728F and are coordinated through technical reviews at the staff and engineering levels. Coordination with other Services is done through the DOD Computer Security Center and the OSD program management reviews.

6. (U) WORK PERFORMED BY: The Electronic Systems Division (ESD), Hanscom AFB, MA, has management responsibilities for the program. Seven AFSC organizations are actively participating in tasks funded under this program element. Contractors include the MITRE Corporation (all projects), Bedford, MA; Computer Corporation of America (Project 2522), Cambridge, MA; Dynamics Research Corporation (Project 2523), Wilmington, MA; Aerospace (Projects 2239, 2522, 2524, and 2526), Los Angeles, CA; and General Dynamics (Project 2526), San Diego, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2239, Computer Security Technology: Develop technologies, techniques, and validation procedures for use in AF/DOD systems in response to the DOD Computer Security Initiative. This project concentrates on: demonstration and transition of "trusted" (i.e., security proven) systems and security mechanisms; enhancement and support of computer security verification/validation procedures to include evaluation and application of emerging verification technologies; and computer security support to the acquisition of AF systems and to the AF Computer Security Program Office (AFCSPO). During FY 1984, work continued on the Pacific Air Forces' (PACAF's) Korean Air Intelligence System (KAIS) Security Interface; a Strategic Air Command Digital Network (SACDIN) penetration analysis was performed; formal security verification methodologies were evaluated and enhanced; and an Automated Threat Assessment Methodology (ATAM) prototype that evaluates computer system security risks was demonstrated. In FY 1985, this project will: finish the KAIS effort; the SACDIN Penetration Analysis task will develop guidelines for computer system penetration prevention; a user's guide will be developed to address the use of formal verification methodologies; and a Multi-Level Secure (MLS) Data Base Management System (DBMS) will be prototyped. In addition, computer security problems in mission critical computer resources will be documented, and the HQ Air Force Systems Command (AFSC) Computer Security R&D Coordinating Committee will be established. In FY 1986, work will begin on a trusted local area network; formal verification methodologies will be enhanced to allow widespread use; a contract will be awarded to start development work needed to meet the computer security requirements (protection of multi-level classified information) of Strategic Air Command (SAC) Statement of Operational Need (SON) 10-82; and a task to address computer system resource control using artificial intelligence will begin.

B. (U) Project: 2522, Requirements Analysis: Develop and apply tools that provide Air Force program offices with rapid insight into the technical performance, cost, schedule, and high risk implications of stated computer resource

system requirements. These tools structure and control changing requirements; explore performance and supportability trade-offs; and examine alternatives prior to making hardware, software, and financial commitments. This project will assist users in their initial application of these requirements analysis and tracking tools. In FY 1984, the project continued application and evaluation of the Automated Interactive Simulation Modeling System (AISIM), an automated tool that explores requirements options; and continued work on the Data Base Design and Evaluation Workbench (DDEW), a prototype system to support comprehensive data base design strategies and evaluation alternatives. In FY 1985, the project will: continue DDEW development; publish the User-System Interface (USI) design guidelines; begin development of a Rapid Prototyping System (RPS); and begin rehosting of Space Division's Software Technology Resource Analysis System (STRAS) to another computer. To insure quick and easy transition of tools to using agencies, computer aided instruction techniques (see Project 2524) will be employed for each automated tool developed. In FY 1986, the project will: continue enhancement and application efforts with AISIM; conduct testing and initial application of the DDEW; continue development of the RPS; complete the STRAS rehost effort; start development of an automated tool to assist system engineers in generating and organizing concepts, and forming requirements from them; and begin work on the Advanced Automated Requirement System (AARS) which will integrate existing tools and techniques for the specification and life-cycle management of system requirements.

C. (U) Project: 2523, Management Control Technology: Develop and evaluate methods for estimating software development costs and defining acquisition strategies and practices that aid in the control of mission critical computer resources. Efforts will support the Joint Logistics Commanders (JLC) conference to eliminate unnecessary duplication and proliferation of software acquisition standards and practices among the three Services. During FY 1984, this project supported the Orlando I Workshop on Post Development Software Support and an Air Force Systems Command-Air Force Logistics Command (AFSC-AFLC) workshop on software quality assurance and produced draft military standards (MIL-STDs) for software development, acquisition, and management. Tasks not in direct support of the JLC included the preparation of a Software Cost Disclosure Guide for use in proposal preparation, an industry survey on Information Resource Management (IRM) practices, and the initial description of a Program Manager's Workbench. In FY 1985, this project will: complete and present training courses for the above MIL-STDs; provide other "as needed" support for the JLC; begin to transition the software quality metrics technology developed under PE 63728F, Advanced Computer Technology and implement the Program Manager's Workbench concept, an effort to identify a set of automated project management tools. In FY 1986, this project will begin work on a software quality metrics standard and achieve full operational capability for the Program Manager's Workbench. Initial design work for a Software Technology and Transition Center (STTC) will begin.

D. (U) Project: 2524, Policy and Procedure Guidance: Develop comprehensive guidance on policies and procedures that lead to improvements in the planning, acquisition, and support of mission critical computer resources. Through the use of guidebooks, video tapes, multimedia training methods, and automated management aids, this project will provide training to Air Force personnel in software acquisition management. During FY 1984, this project: finished development of the Training and Performance Support System (TPSS) prototype; developed a software acquisition management course; completed the Handbook for Flight Critical Systems; and development of technical documents to supplement

the Computer Resource Acquisition Course (CRAC) at Brooks AFB, TX, was completed and work started on case studies. In FY 1985, this project will: conduct an implementation study for the Training and Performance Support System (TPSS) and the prototype will be transitioned to the System Acquisition School at Brooks AFB, TX; the Handbook for Flight Critical Systems will be printed and a training course presented; courseware for the User-System Interface/Automated Interactive Simulation Modeling System (USI/AISIM) efforts will be contracted; and work on the CRAC case studies will be completed and implemented. In FY 1986, the USI/AISIM courseware will be completed and work initiated on courseware for other products of this program element (PE); and the effort to evaluate the transition of the Training and Performance Support System (TPSS) to the Aeronautical Systems Division (ASD) to assist in addressing flight critical training applications will begin.

E. (U) Project: 2526, Software Engineering Tools and Methods: Develop and implement a comprehensive set of integrated tools to improve the software development, acquisition, and support (e.g., maintenance) processes. In addition, this project will place major emphasis on providing planning and support for the introduction of the Ada High Order Language (HOL) into the Air Force. During FY 1984, this project's Ada Transition Planning, Preparation for Parallel Development of an Automated Message Processing System (JAMPS) in Ada, and Tactical Ada Guidance (TAG) tasks provided guidance to program offices regarding Ada acquisition issues. TAG was the first laboratory development effort to apply Ada in a mission critical computer system. The project was broadened to begin efforts to transition operational Ada products to the field, including hands-on evaluations of various programming support tools and run-time environments. This work will help ensure that these products are fully mature before they are placed in the field and provide valuable information to the Ada Joint Program Office (AJPO) sponsored Evaluation and Validation Team. Support was also provided to redevelop KC-135 Avionics Modernization equipment using Ada in order to compare the Ada and JOVIAL computer languages. In FY 1985, this project will: finish the TAG effort; evaluations of tools and run-time environments will continue; work will begin to recode JAMPS software in Ada; a SAC requested analysis will be done on their Ada maintenance environment needs; and the Ada Integrated Environment (AIE) compiler, sponsored by the AJPO and the Air Force, will be tested and evaluated in a command, control, and communications (C^3) application. In FY 1986, the AIE compiler will be upgraded to perform at production quality level for C^3 applications; test and evaluation of the entire AIE will begin; a test and evaluation of an Ada C^3 programming support environment will be performed; JAMPS software written in Ada will be completed and operational; an advanced Ada Development Environment will be designed to improve programmer productivity by incorporating expert systems, rapid prototyping, and Ada environment technologies; and benchmarks for Ada will be developed and applied to space and C^3 environments. Lessons learned from all evaluations will be provided to DOD program offices and committees.

F. (U) Project: 2983, Logistics Information Management Support System (LIMSS): This is a long term development effort to provide a standard architecture and a C^3 infrastructure that will network various forms of information processing via telecommunications for all levels of logistics functions. It provides the overall planning and coordination, system engineering, development, integration and test, and the implementation of the LIMSS pilot and follow-on programs. LIMSS has been formulated as the means to fill the void between the individually developed current and future programs, and to provide a broad plan for an overall logistics systems architecture. During FY

1984, contracts were signed to perform the planning and architecture development for the Logistics Information Management Support System (LIMSS) program; efforts began on the analysis, requirements definition, and planning of the implementation of the Air Force Equipment Maintenance Management Information System (AFEMMIS); the initial structure for intc"lonrdb di nec More Automated Maintenance System (CAMS), the Equipment Maintenance Data Base (EMDB), and the Generic Integrated Maintenance and Diagnostics System (GIMADS) was defined and an action plan was prepared; and additional Logistics Information Management Support System (LIMSS) candidate pilot/demonstration projects were identified and are being assessed and prioritized for FY 1985-1986 implementation. In FY 1985, the program action plan will be completed; analyses of major information systems architectures will continue and the near term LIMSS architecture will be defined initial Air Force Equipment Maintenance Management Information System (AFEMMIS) requirements will be established and prioritized; the functional interface between CAMS, EMDB, and GIMADS will be defined; an Interface Control Working Group (ICWG) will be established; and selected additional pilot/demonstration projects will be started and initial tests and evaluations will be done. In FY 1986, analyses of evolving logistics and engineering systems will be performed and the near term architecture will be refined to incorporate additional functions and systems; alternative architectures will be evaluated and selected automated technical information techniques and technologies will be incorporated; the initial configuration of AFEMMIS will be expanded to include other maintenance systems as well as interfaces with supply and distribution information systems AFEMMIS integration testing will be started; and pilot/ demonstration projects utilizing Phase IV equipment and Defense Data Networks will be conducted at selected locations to identify problems, demonstrate solutions, and obtain user inputs.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64742F
DOD Mission Area: #327 - TIARA for Tactical Air Warfare

Title: Precision Location Strike System
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		72,927	79,096	63,081	27,365	28,176*	TBD*

* PLSS P3I effort will begin in FY90. The cost of this effort has not been determined

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A key element in carrying out the missions of air superiority, interdiction and close air support is suppressing the extensive and layered enemy threat radars and surface-to-air missile systems. The Precision Location Strike System (PLSS) is critical to defense suppression efforts. PLSS is a tactical Air Force system designed to accurately locate enemy air defense emitters and destroy them in near-real-time with a It is the only system in being or in development with the rate of attack and certainty of kill necessary to signficantly reduce the attrition of friendly air forces in Europe. Knowing the location of threat emitters is fundamental to developing electronic combat strategy and tactics for countering and defeating them. Once emitters have been located they can be destroyed, jammed or avoided. PLSS contributes to all three tactics and provides overall coherence to the effective use of all defense suppression assets. It provides for attack and destruction of priority emitters using standoff weapons or other munitions carried by PLSS targeted F-16s. It will enhance the effectiveness of the F-4G/Wild Weasel/High-speed Antiradiation Missile (HARM) systems and jammers such as the EF-111 by cueing them to the targets. The baseline PLSS has significant capability to provide tactical electronic intelligence (ELINT). At Congressional direction the Air Force in conjunction with the National Security Agency (NSA) is enhancing the ELINT capability under the PLSS Intelligence Augmentation System (PIAS) project in the Tactical Cryptologic Program (TCP).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	69,027	82,996	63,344		56,676	TBD
Aircraft Procurement (PE 27244F)	(8,800)*	129,300	111,600		15,200	268,400
Other Procurement (PE 27244F)	(18,300)*	77,363	49,278		13,258	158,200

* FY 1984 funds for PLSS in the TR-1 line, PE 27215F.

(U) FY 85 Aircraft Procurement and Other Procurement reduced in Congressional action by $37.1 million and $9.0 million, respectively. FY 86 Other Procurement reduction ($11.1 million) results from rephasing software development laboratory refurbishment and enhancement from FY 86 to FY 87.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)[1]

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	(8,800)*	92,200	112,800	54,400	6,000	277,700
Quantities (AMS)		4	6	2+4**		
Other Procurement:						
Funds	(18,300)*	63,379	38,165	28,765	6,421	155,030
Quantities (CPS/SNS)		1/6	1**/4+4**			
Military Construction:						
Funds		15,200	6,660			21,860

1/ Funds and quantities shown procure subsystems (Central Processing Subsystem (CPS), Airborne Mission Subsystem (AMS) and Site Navigation Subsystem (SNS)) which comprise a complete PLSS system for the US Air Forces in Europe and refurbishment of the RDT&E system to an operational status for training and contingency deployment by Tactical Air Command.
* FY 1984 funds for PLSS are in the TR-1 line, PE 27215F.
** Indicates refurbished RDT&E subsystems.

5. (U) RELATED ACTIVITIES: The PLSS airborne relay vehicles are procured under PE 27215F, TR-1 Squadrons. Interoperable Data Link (IDL) equipment for PLSS (both ground station and airborne) is being procured under the TR-1 line. F-16 aircraft capable of carrying and employing the PLSS Adaptive Targeting Data Link (ATDL), formerly the Vehicle Navigation Subsystem (VNS), will be produced under PE 27133F, F-16 Squadrons. The development of the PLSS ATDL, used for providing aircraft with near real time targeting from PLSS, was transferred from the PLSS line to the F-16 line (Project 2970) in FY 84 at Congressional direction. The PLSS ATDL will also be used to target the Tactical Missile Systems (TACMS) to provide effective long range standoff kill capability for high value defense suppression and interdiction roles. Congress has directed that PLSS be put in the Tactical Cryptologic Program where it can be integrated with other tactical electronic reconnaissance systems. The Air Force has implemented this direction. The Air Force and the National Security Agency (NSA) are developing the PLSS Intelligence Augmentation System (PIAS) in the Tactical Cryptologic Program (TCP). The PIAS will be an integral part of the PLSS Central Processing Subsystem (CPS).

6. (U) WORK PERFORMED BY: Overall management of this program element is by Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. PLSS Interoperable Data Link and TR-1 work is contracted through Air Force Logistics Command Detachment 8, 2762 Logistics Squadron (Special), Robins AFB, GA. The PLSS prime contractor with total system integration responsibility is Lockheed Missiles and Space Company (LMSC), Sunnyvale, CA. LMSC has transferred the production of PLSS to Lockheed Austin Division (LAD), Austin, TX. Major subcontractors include E-Systems Inc., Garland, TX (intercept equipment); Harris Corp., Melbourne, FL, (data link equipment); Control Data Corp., Minneapolis, MN (digital processing equipment); Rockwell-Collins, Richardson, TX (ground communications equipment); IBM, Owego, NY (signal processing equipment); Brunswick, Marion, VA (shelters); and Motorola Corporation, Phoenix, AZ (displays). Associate contractors include General Dynamics, Ft Worth, TX (F-16); Sperry Univac, Salt Lake City, UT (IDL); and Lockheed Aircraft Corp., Burbank, CA (TR-1 equipment). SofTech Corporation, Dayton, OH, provides independent validation and verification of the LMSC developed PLSS software. Lincoln Laboratory, Lexington, MA, MITRE Corp., Bedford MA and Aerospace Corporation, Los Angeles, CA, perform engineering studies.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 1190, Precision Location Strike System

A. (U) Project Description: The PLSS project (Project 1190) is the only present development effort in this Program Element. PLSS will provide targeting-accuracy, integrated location and strike of hostile air defenses continuously in near real time and all weather over a theater-wide area. PLSS is the foundation of the electronic combat force structure and provides lethal defense suppression to reduce attrition of penetrating attack aircraft. PLSS will provide current Electronic Order of Battle (EOB) information enabling the commander to assess the immediate threat to his attack forces.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The procurement of items for testing was completed. Qualification and acceptance testing of Full Scale Development (FSD) hardware units continued. Contractor system integration testing and single aircraft flight tests were initiated. The first TR-1 flight of the Airborne Mission Subsystem (AMS) was in December 1983 and was highly successful. Nine additional single aircraft test missions were successfully flown. The government test team was formed in January 1984 to monitor contractor integration testing prior to Air Force System Acquisition Review Council (AFSARC) IIIA milestone and to conduct the combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E). Advance procurement and long lead buy of Government Furnished Equipment (GFE) for production was procured in the TR-1 line in July 1984, approximately four months behind schedule. Due to late subcontractor deliveries and software schedule slips, the contractor integration testing and flight tests also slipped approximately four months. The integration delay slipped the planned AFSARC IIIA milestone into FY 1985. The F-16 Adaptive Targeting Data Link (ATDL) studies continued after development was reinitiated in the F-16 program, PE 27133F. PLSS Intelligence Augmentation System (PIAS) development was initiated.

(2) (U) FY 1985 Program: Contractor system integration and combined DT&E/IOT&E flight testing will be completed from the contractor's Sunnyvale facility. Combined DT&E/IOT&E will continue when the system is moved to Nellis AFB in June 1985. Software development, including F-16 Adaptive Targeting Data Link (ATDL) targeting modules, will continue. Logistics support equipment development will continue. Limited production is scheduled to be approved by an AFSARC IIIA in March 1985. The production contract award is scheduled for April 1985. An AFSARC IIIB will tentatively convene for full production approval in December 1985. Construction of the hardened European ground site and three operations/maintenance facilites will begin. First unit training and provisioning will occur. The current estimate is based on an FY 1983 independent cost estimate (category II confidence level). An updated cost estimate based on the evaluation of the contractor's proposal (category I confidence level) is due prior to the AFSARC IIIA. Logistics support equipment development will continue during the test program.

(3) (U) FY 1986 Planned Program and Basis for 1986 RDT&E Request: Air Force Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) will be completed in FY 1986. Follow-on Test and Evaluation (FOT&E) will commence at the end of DT&E/IOT&E. The FOT&E will provide additional testing of support equipment as well as deficiency corrections found during DT&E/IOT&E and software enhancements not evaluated during DT&E/IOT&E. FOT&E will provide additional training of the initial cadre of the European system. Procurement options for additional ground and airborne hardware will be exercised. Construction of Site Navigation Subsystem sites, Operations facilities, Unaccompanied Enlisted Personnel Housing, and Integration Support Facility begin. Hardware for the European operational capability will be integrated, tested and shipped to Europe after the European communications upgrade and PIAS are integrated and tested. Software enhancement development will continue. The F-16 Adaptive Targeting Data Link (ATDL) software and integration development continues.

(4) (U) Program to Completion: Logistics development, testing and procurement as well as hardware procurement will continue. Training and provisioning will continue. The production system will be deployed. Location mission Initial Operational Capability (IOC) will be accomplished. The Software Development Laboratory will be delivered to the Air Force and form the basis of the Integration Support Facility. Preplanned product improvements will be initiated. Tactical intelligence improvements will continue. The RDT&E system will be refurbished and used for training and contingency deployment. Separate IOCs will occur for each strike mission weapon and aircraft.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Area Coordinating Paper Number 4		March 1972
(2)	(U)	Tactical Air Forces Required Operational Capability 314-74, Validated		October 1974
(3)	(U)	Defense Systems Acquisition Review Council IIA (DSARC IIA)/Milestone II		July 1977
(4)	(U)	Full Scale Development Contract Award		September 1977
(5)	(U)	Airborne Relay Vehicle Decision		October 1978
(6)	(U)	Preliminary Design Review (PDR)		October 1979
(7)	(U)	Critical Design Review (CDR)		March 1983
(8)	(U)	First Aircraft Mission Subsystem (AMS) flight		December 1983
(9)	(U)	Start Contractor system flight test/DT&E/IOT&E		July 1984
(10)	(U)	AF Systems Acquisition Review Council IIIA (AFSARC IIIA)	*(September 1984)	March 1985
(11)	(U)	Production Contract Award	*(October 1984)	April 1985
(12)	(U)	AFSARC IIIB	*(March 1985)	December 1985
(13)	(U)	Start Follow-on Operational Test and Evaluation (FOT&E)	*(October 1985)	February 1986
(14)		Location Mission Initial Operational Capability (IOC)	[ ]	TBD

* Dates presented in FY 85 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES:

(10) (U) AFSARC IIIA slipped 6 months because $47 million of contractor effort had to be rephased to stay within funding limitations due to greater then expected subcontractor costs and the deletion of the F-16 Vehicle Navigation Subsystem (VNS) from the program. This rephasing resulted in deferred hardware and software deliveries to the test program. In addition, the TR-1/U-2 aircraft fleet was grounded for approximately 2 months. The completion of contractor integration testing has slipped from September 1984 to February 1985 due to both of these circumstances.

(11) (U) The production award slipped six months due to the six month slip in AFSARC IIIA

(12) (U) The AFSARC IIIB slipped by nine months due to the six month slip in the preceeding schedule and a decision to delay the AFSARC IIIB until additional supportability data could be collected

(13) The IOC slipped from the previous estimate of [ ] but the extent of the slip will not be fully known until approximately March 1985 when the initial production contract negotiations are complete and the impact of the test slips have been fully assessed. In addition, the Air Force is examining alternatives using RDT&E hardware to provide an operational capability as close to [ ] as possible.

Budget Activity: 4, Tactical Programs
Program Element: 64742F, Precision Location Strike System (PLSS)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): Combined DT&E is scheduled to begin in March 1985. Detailed test planning is progressing. The Air Force test team has been assembled and is carefully monitoring contractor testing.

(U) Contractor development testing accomplished to date includes approximately one-half of the allotted contractor integration flight test missions. All RDT&E hardware has been delivered and integrated. Ground integration testing is complete. Single aircraft integration flight testing completed in December 1984. Two aircraft integration flight testing is scheduled to be completed in late January 1985, and three aircraft contractor testing is to be completed in March 1985. Software development and testing continues with incremental deliveries to the Air Force.

2. (U) Operational Test and Evaluation (OT&E): Operational testing of the PLSS will be accomplished as a combined development test and evaluation and initial operational test and evaluation (DT&E/IOT&E). The purpose of the IOT&E is to determine the operational effectiveness and suitability of the PLSS when employed in its operational configuration and environment. The test and evaluation program will be fully integrated to minimize test duplication. The Air Force Operational Test and Evaluation Center (AFOTEC) will direct the IOT&E, using a team of trained Air Force operations and maintenance personnel and resources from the Tactical Air Command (TAC), Electronic Security Command (ESC), Air Force Logistics Command (AFLC), Strategic Air Command (SAC), and the Air Training Command (ATC).

(U) The system to be tested will be a full scale development (FSD) system. The major differences between the FSD system and the production system are in the central processing communications element (CPCOM) which provides the communications interfaces with command, control, communications and intelligence (C^3I) and logistics support channels. Interfaces for the FSD system do not meet current communications standards and require a work-around for the IOT&E test. A full evaluation of C^3I will have to be deferred until the system is deployed to Europe. Modifications are being made for the production system (i.e., color display, increased display capability, etc.).

(U) Operational test scenarios are being established to evaluate the ability of the system to identify and locate electronic emitters and provide this information to appropriate C^3I elements. Budget constraints and the delay of F-16 PLSS interface (the F-16 will be used as the primary weapons delivery aircraft) have necessitated a phased test approach. Total anticipated DT&E/IOT&E includes an evaluation of a PLSS surveillance capability followed by evaluation of an F-16 attack capability. During the F-16 attack capability phase of testing, PLSS ability to accurately provide targeting information to multiple delivery aircraft will be evaluated. PLSS susceptibility to both friendly and enemy electronic countermeasures (ECM) will be tested throughout the combined test effort. Vulnerability of PLSS airborne and ground components will also be evaluated. Reliability, maintainability, availability, and logistics supportability of ground and airborne subsystems will be evaluated to the extent support equipment will be available.

Budget Activity: 4, Tactical Programs
Program Element: 64742F, Precision Location Strike System (PLSS)

(U) Full-up system contractor integration testing has started at the contractor's facility in Sunnyvale, California. Their effort is currently in flight test and is to continue until March 1985. The combined test force will accomplish an over-the-shoulder evaluation during this period to gather data to support the initial production decision scheduled for March 1985 and the subsequent full production decision. Government combined testing (DT&E/IOT&E) will begin at the contractor's facility in late March 1985 and continue until June 1985.

(U) Data collection will center on flying and controlling a TR-1 triad, evaluating data link linkage and navigation, emitter collection control and processing, emitter identification and location operations, Electronic Countermeasure (ECM) susceptibility, TEMPEST testing, TR-1 survivability and suitability (to the extent possible with contractor data/support). In June 1985 the PLSS ground station will be moved to Nellis AFB, Nevada, where it will be assembled in its operational configuration for full-up DT&E/IOT&E testing. The test at Nellis will be conducted from July 1985 to January 1986.

(U) ECM susceptibility bench testing of the PLSS interoperable data link (IDL), airborne intercept element (AIE), and distance measuring equipment (DME) has been completed. IDL performance in an ECM environment was within specification. Data from the AIE and DME are in the final analysis stages. Interceptibility evaluations are scheduled for the 2nd and 3rd quarters of FY 1985. Accessibility will be evaluated during combined DT&E/IOT&E.

(U) Test Reports Published: 4X Interoperable Data link ECM Bench Test, October 1984.

3. System Characteristics: The following are goals for critical parameters to be evaluated during Development Test and Evaluation/Initial Operational Test and Evaluation.

Parameter	Decision Coordinating Paper Thresholds	Objectives (DCP Goals)	Demonstrated Performance
Probability of:			
Location			TBD
Identification			TBD
Frequency Coverage			TBD
Range			TBD
Accuracy (R/D=1)			
Strike			TBD
Location			TBD
System			TBD
Mission Completion Success Probability	0.80	0.85	TBD

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Interoperable Data Link Electronic Countermeasure susceptibility Bench Test.	August 83	August 83	Test and analysis complete. Report provided in Oct 84. Preliminary results described above.
Airborne Intercept Element Electronic Countermeasure susceptibility Bench Test.	June 84	June 84	Test complete. Analysis is in final stages. Report provided in Dec 84.
Distance Measuring Equipment Electronic Countermeasure susceptibility Bench Test	July 84	July 84	Test complete. Analysis in final stages. Reports due in Jan 85.

T&E Activity (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
Contractor Integration	December 83 - March 85	Ongoing	Only single aircraft integration testing has been accomplished to date. Triad flight tests are required before proceeding to government testing.
Combined government testing at Sunnyvale, CA	March - June 85		The current schedule is considered high risk and has no slack. This schedule is dependent upon successful completion of the contractor integration effort (Dec 83 - June 85).
Combined government testing at Nellis AFB, NV	July 85 - January 86		This phase of the test is dependent upon successful completion of the contractor integration effort (Dec 83 - June 85) and combined government testing at Sunnyvale, CA (March - June 85).

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64750F
DOD Mission Area: #327 - TIARA for Tactical Air Warfare

Title: Intelligence Equipment
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	14,195	15,255	13,481	16,576	Continuing	N/A
1174	Intelligence Security Equipment	918	969	1,214	865	Continuing	N/A
1955	Air Force Support to DOD Indications and Warning	8,335	10,005	8,164	11,511	Continuing	N/A
2053	Foreign Technology Division Intelligence Processes	3,712	3,312	4,103	4,200	Continuing	N/A
2991	Technical Applications Development	1,230	969	0	0	0	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element supports United States Air Force operating commands by performing the engineering development of ground equipment and/or techniques used to process, integrate, display and distribute intelligence data. This equipment will reduce the time required for the exploitation of intelligence data to meet the needs of Air Force agencies producing strategic, tactical, and scientific and technical intelligence. Equipment and techniques are also developed to counter the foreign intelligence threat to the USAF mission.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	12,675	15,255	15,020		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. RELATED ACTIVITIES: Intelligence program activities of joint service interest such as the Indications and Warning efforts are coordinated with the Defense Intelligence Agency. All R&D efforts under Project 1174 are coordinated with the thereby preventing duplication

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PE #: 64750F

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of effort and promoting exchange in capabilities among its members. Exploratory and advanced development activities related to this program are conducted under Program Element 62702F, Command, Control, and Communications and 63789F, Command, Control, and Communications Advanced Development. Other related Air Force activities include Program Elements 31011G, Cryptologic Activities; 31310F, Foreign Technology Division; 35127F, Foreign Counterintelligence; 35128F, Security and Investigative Activities; 31313F, Defense Dissemination Program; 27431F, Tactical Air Intelligence System Activities; and 27435F, Tactical Reconnaissance Imagery and Exploitation. In addition, procurement and operations and maintenance funding provided by Program Elements 31328F, Strategic Air Command; 31334F, Air Force Other Commands; and 31335F, Air Force Automated Data Processing Support to the General Defense Intelligence Program, are combined together with RDT&E funding from this program element in single integrated programs, managed by the Rome Air Development Center, for upgrades at Strategic Air Command, Military Airlift Command, and Aerospace Defense Command/Space Command. The parceling of funding to the various appropriations complies with policy regarding funding of Automated Data Processing resources. Efforts under Project 1955 for Aerospace Defense Command/Space Command are closely coordinated with the development of the Space Defense Operations Center funded in Program Element 12311F, North American Air Defense Command Combat Operations Center.

6. (U) WORK PERFORMED BY: The Air Force manager for all projects in the Program Element is the Rome Air Development Center, Griffiss AFB, NY. Major contractors are: (Project 1955) Planning Research Corporation, McLean, VA and Pattern Analysis and Recognition Corporation, New Hartford, NY; (Projects 1955 and 2053) International Computing Company, McLean, VA; and, (Project 2053) AVCO, Wilmington, MA and TRW, Los Angeles, CA. In addition, there are twenty other contractors with a total current contract value of $13,746 thousand.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 1174 - Intelligence Security Equipment. With the constantly changing state-of-the-art in acoustics, optics and electronics, both domestic and foreign, the Air Force Office of Special Investigations (AFOSI) needs a research and development program to maintain the effectiveness of its Technical Surveillance Countermeasures (TSCM) program and criminal/counterintelligence investigative posture. This project provides the AFOSI with specialized equipment and devices to accomplish TSCM surveys and provide technical support for counterintelligence, counterespionage, and criminal and fraud investigative operations. Several independent tasks are conducted simultaneously. As tasks are completed, new tasks are initiated to satisfy outstanding, validated requirements. In FY 1984, completed development of spread spectrum receiving techniques applicable to a wideband TSCM receiver and an advanced development model of a portable ultra-broadband direction finding system. Began development and fabrication of a covert communications radio system, a TSCM antenna, a signal processor to be used with the wideband TSCM receiver, a study of techniques for eavesdrop microphone detection/location, and modifications to a [ ] narrowband TSCM receiver to meet AFOSI requirements. In FY 1985, the project will complete all the tasks begun in FY 1984 and begin development of an automated TSCM signal analyzer that can quickly and continuously scan the radio frequency spectrum and characterize all signals by type of modulation, signal amplitude and time of detection. In FY 1986, will continue development of the automated TSCM signal analyzer. Based on studies completed in FY 1985, begin development of equipment to detect both magnetic and nonmagnetic types of microphones hidden in walls. Begin development of a system that will

automatically determine all parameters of an [redacted] Finally, using techniques developed by Rome Air Development Center under an exploratory development program completed in FY 1984, begin design and fabrication of [redacted] if it is using any interceptable transmission system. During the following years, in addition to other new tasks in response to Air Force Office of Special Investigations' requirements, results of previous tasks addressing portions of the wideband Technical Surveillance (TSCM) receiver design will culminate in the development of a complete, single unit wideband TSCM receiver to detect [redacted] signals.

B. Project: 1955 - Air Force Support to DOD Indications and Warning (I&W). I&W support to Strategic Air Command (SAC), Aerospace Defense Command/Space Command (ADCOM/SPACECMD) and Military Airlift Command (MAC) activities and to the Defense Intelligence Agency-managed I&W system [redacted] This project will significantly improve SAC, ADCOM/SPACECMD and MAC I&W capabilities to support the time-sensitive national/military decision making process envisioned for the mid to late 1980s by providing state-of-the-art advances to the commands' abilities to analyze, correlate and produce operational intelligence. Improvements are performed in an evolutionary manner based on dynamic user requirements and worldwide threats. Compatibility with the National Military Intelligence Center to ensure DOD interoperability is critical. The project will link worldwide I&W nodes in an interactive data/problem sharing mode. It may also improve intelligence support to other Air Force components of the DOD I&W System. The capability is required to [redacted] to assist Air Force command and control functions. [redacted] In FY 1984, (a) at SAC, completed preliminary definition and design of upgrades for the Intelligence Operations Center during the 1985-1990 timeframe, developed and demonstrated a prototype capability to [redacted] continued efforts to provide I&W analysts selective access to other SAC intelligence data base systems and upgrades to analyst workstation; (b) at ADCOM/SPACECMD, completed initial improvements to the foreign launch assessment capability and operational space/missile oriented indicator analysis techniques. Software development for the initial block of work, as well as basic specifications for the second block and basic overall specification for the total ADCOM Intelligence Data Handling System (IDHS) Upgrade were delayed until late in FY 1984 because of Congressional funding cuts; and (c) at MAC, completed all specifications for the automated Military Airlift Intelligence System and began software development. In FY 1985, will (a) at SAC, complete [redacted] to support indicator data base development efforts in FY 1986-1988, [redacted] prototype development, moving target analysis demonstration and analyst workstation modifications and continue efforts to upgrade Intelligence Operations Center capabilities, to include: begin development of Intelligence Operations Center upgrade specification and subsystem specifications and the SAC subset of the Worldwide Indicator Monitoring System and publish technical reports defining electronic intelligence, imagery intelligence and order of battle interface, processing and decision requirements for satisfaction of

FY 1986-1988 functional needs; (b) at ADCOM/SPACECMD, complete development of initial block of software and second block and system specifications, begin development of an capability for intelligence use in the ADCOM IDHS Upgrade and an processing system; and (c) at MAC, produce the specification for the second block of the Military Airlift Intelligence System (MAIS), continue initial block of software development and begin integration. In FY 1986, will (a) at Strategic Air Command, complete Intelligence Operations Center Upgrade system specifications development, the design of electronic intelligence, imagery intelligence and order of battle interfaces based on FY 1985 work, and development of the Worldwide Indications Monitoring System subset and begin efforts to: develop indicator data base/flagging capabilities necessary for area monitoring, warning analysis and indications and warning event assessment; develop current force deployment and force normalcy profiles and information requirements; develop an events oriented historical data base; define system requirements to aggregate and correlate these data with other source information; and, implement capability; (b) at Air Defense Command/Space Command (ADCOM/SPACECMD), integrate initial block of software which rebuilds and redesigns existing programs to operate on the new computers, and

Continue developments as well as begin development of the second block of software which can provide initial support to the Space Defense Operations Center; and, (c) at Military Airlift Command, providing automated support for the following intelligence activities:

Begin development of the second block which will automate

C. Project: 2053 - Foreign Technology Division (FTD) Intelligence Processes. FTD's mission is to to acquire, evaluate, analyze and report on foreign scientific and technological progress in response to Department of Defense/Defense Intelligence Agency tasking. Current FTD administrative, operational and logistic management capabilities are inadequate to cope with current and future intelligence production requirements. The advent of new intelligence collection systems and extensive and varied advancements in foreign technology necessitate the development of automated equipment/techniques to enhance and speed up the intelligence production cycle. This project improves the FTD capability to acquire, evaluate, analyze, and report on foreign scientific and technical information and material. These improvements will assist in responding to intelligence requirements vital to operational commanders, research and development planners, and national level agencies. It will develop new capabilities to provide timely and accurate threat assessments of foreign weapon system technology. Analyst oriented techniques will support analysis of foreign command, control, and communications (C^3), electronic warfare, and ballistic missile, space and aerodynamic systems. Database management techniques and text and sensor data processing capabilities pertinent to FTD's mission will also be addressed. Numerous independent tasks are conducted simultaneously. As tasks are completed, new tasks are initiated to satisfy outstanding, validated requirements. In FY 1984, completed methods of evaluating liquid rocket engine configurations, operation and testing of a special C^3 antenna, satellite externals analysis capability and foreign Electronic Warfare Support Measures analysis methodology. Continued maneuvering reentry vehicle design and missile guidance system error analysis capabilities, development of a standard query language, implementation of basic wideband imaging radar exploitation at FTD, and development of Real Time Optical System data analysis algorithms.

Began aerodynamic missile guidance analysis, automation of infrared/electro-optical and radar data screening and exploitation to prepare reports on validation of current ionospheric propagation analysis capability, infrared signature and sensor modeling, and missile propellant identification In FY 1985, will complete all but the first four tasks begun in FY 1984. Begin modeling both the capabilities, study of hardware and software requirements to support and integrate threat assessment modeling/ simulation at FTD, aircraft aerodynamic performance analysis, command, control and communications systems analysis, expansion of the wideband imaging radar exploitation capability, analysis of and extraction of aerospace vehicle performance parameters In FY 1986, will complete aerodynamic missile guidance analysis and Continue all other tasks, and begin development of a analysis capability, implementation of efforts completed in FY 1985, characterization and development of an automated capability to analyze the results of Soviet management decisions on their research and development efforts and production.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64753F
DOD Mission Area: #265 - Intratheater Airlift

Title: Combat Helicopter Modernization
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		35,672	34,306	14,100	8,500	0	138,419

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Combat Helicopter Modernization (HH-60A) Program will provide the capability to rescue downed combat aircrews in current and future threat environments. Changes in the threat have rendered ineffective many of the combat rescue techniques which were so successful in Southeast Asia (2700 combat saves). The HH-60A Night Hawk is a derivative of the Army UH-60A Black Hawk and is specifically designed for clandestine, single ship combat rescue operations. Modifications include extended range (including air refueling capability), more powerful engines and transmissions (both from the Navy SH-60B Seahawk) and improved avionics for precision low level navigation at night and under the weather.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	36,222	81,306	28,986		6,806	199,371
Aircraft Procurement:*						
Program Element #44102F						
Funds		22,500	171,900		1,966,100	2,160,500
Quantities		(0)	(3)		(124)	(127)
Program Element #44011F						
Funds			23,700		578,200	601,900
Quantities			(0)		(28)	(28)

* Includes Initial Spares

A. (U) Decreased RDT&E funding in FY 1985 is due to a Congressional budget reduction. Decrease in FY 1986 and total RDT&E requirements is due to deletion of one flight test aircraft and adverse weather avionics from the test program and to receipt of firm fixed price contractor proposals for the remainder of the development program.

B. (U) Decreased procurement funding in FY 1985 is due to Congressional budget reduction. Decrease in FY 1986 and subsequent funding requirements is due to program restructuring -- reducing the planned buy from 127 aircraft for combat rescue (PE #44102F) and 28 aircraft for special operations (PE #44011F) to 90 aircraft for combat rescue only and eliminating adverse weather avionics from the production configuration. Also contributing to the cost reduction are firm fixed price contractor proposals for the entire production program at considerable savings to the government.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	0	6,100	122,100	340,200	625,900	1,094,300
Quantities	0	0	3	25	62	90
Military Construction:						
Funds				980	9,757	10,737

5. (U) RELATED ACTIVITIES: Development of a weapon system trainer and cockpit procedures trainer is funded under program element 64227F, Flight Simulator Development. The Combat Talon II (MC-130H), contained in program element 44011F, derives its core avionics architecture from the HH-60A and shares in the development of certain common items.

6. (U) WORK PERFORMED BY: The Air Force management of the HH-60A is accomplished by the Air Force Systems Command Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The Full Scale Development contract for avionics systems integration was awarded to International Business Machines, Owego, NY, in October 1982. The Full Scale Development contract for airframe modifications was awarded to Sikorsky Aircraft Division of United Technologies, Stratford, CT, in November 1982.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: Combat Helicopter Modernization

A. (U) Project Description: See paragraph 2.

Program Element: #64753F
DOD Mission Area: #265 - Intratheater Airlift

Title: Combat Helicopter Modernization
Budget Activity: #4 - Tactical Programs

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Avionics Critical Design Review was completed. Airframe modification of the flight test vehicle was completed. Ground testing accomplishments include fuel system, structural and dynamic response. Flight testing accomplishments include flight loads, vibration survey and fuel system (air refueling) demonstration. Software validation and hardware integration was started.

(2) (U) FY 1985 Program: Air Force Systems Acquisition Review Council (AFSARC) Milestone II review was completed. Phase I of the airframe flight test was completed and the test vehicle transferred to IBM for avionics modifications. Software validation and system integration demonstration will be completed. Avionics modifications will be completed and the avionics flight test will begin. Advance buy funds for Lot 1 production will be released.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Avionics developmental testing will be completed. Dedicated Initial Operational Test and Evaluation (IOT&E) will begin. Low rate production (3 aircraft) will begin. Cost estimates were based on sole source firm fixed price contractor proposals, are considered mature (Category II), and were subjected to comprehensive review in June 1984.

(4) (U) Program to Completion: Dedicated IOT&E will be completed and follow-on Operational Test and Evaluation will begin in FY 1987. AFSARC III will also occur in FY 1987 followed by the start of full rate production. Initial operational capability is planned for FY 1988 and final deliveries in FY 1991.

C. (U) Major Milestones:

	Milestones	Dates
(1) (U)	Military Airlift Command Statement of Operational Need	December 1977
(2) (U)	Requirement Validation	September 1979
(3) (U)	Air Force Mission Element Need Statement Approval	November 1980
(4) (U)	AFSARC Review/Full Scale Development (FSD) go-ahead	July 1982
(5) (U)	FSD Contract Award	October 1982
(6) (U)	First Flight (with Airframe Mods only)	January 1984
(7) (U)	Critical Design Review	April 1984
(8) (U)	AFSARC II (Lot I long lead approved)	October 1984
(9) (U)	Avionics Flight Test Start	June 1985
(10) (U)	Technical Review/ Low Rate Production Start	FY 1986
(11) (U)	AFSARC III (major production decision)	FY 1987
(12) (U)	Initial Operational Capability	FY 1988

Budget Activity: 4, Tactical Programs
Program Element: 64753F, HH-60A Program

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): Combined DT&E and Initial Operational Test and Evaluation (IOT&E) is being conducted by a combined task force as described in the 15 August 1984 HH-60A Test and Evaluation Master Plan. DT&E/IOT&E is being conducted on a modified UH-60A helicopter. During initial testing the aircraft had only airframe modifications and was used primarily for aerodynamics, mechanics, and fuel system tests. Initial airframe testing has now been completed and the aircraft is being modified with the full avionics suite. Avionics flight testing will begin in June 1985. The DT&E/IOT&E and production aircraft will be similarly configured.

(U) The primary objectives of DT&E are to: assist in the engineering design and development process; verify accomplishment of specification requirements; characterize the performance of the system; and ensure that critical issues have been sufficiently resolved to permit a major production decision at Milestone III.

(U) The US Army Aviation Research and Development Command (AVRADCOM) has accomplished a significant amount of DT&E on the UH-60A airframe. The US Naval Air Systems Command has accomplished extensive DT&E on a derivative of the UH-60A (the SH-60B Seahawk) which will provide the engines, transmission, automatic flight control system and rescue hoist planned for the HH-60A. Data from these tests applicable to the HH-60A airframe and systems will be used to the greatest extent practical to reduce HH-60A testing requirements.

(U) The first flight was on 4 February 1984. Contractor DT&E for the airframe modifications was completed by the Sikorsky Aircraft Company in April 1984. The aircraft was then flown to Edwards AFB, CA for the combined DT&E/IOT&E which will continue until the planned major production decision in early 1987. Air Force DT&E will be conducted by the Air Force Flight Test Center. The service program manager is Mr James Singer, Aeronautical Systems Division, Wright-Patterson AFB, OH.

(U) Data on Reliability, Maintainability, Availability and Logistics Supportability will be collected during flight testing using the Air Force Flight Test Center System Effectiveness Data System. Aircraft maintenance will initially be performed by contractor personnel with Air Force personnel participating through over-the-shoulder or realistic on-the-job training. Complete Air Force maintenance will be planned for the earliest possible date.

2. (U) Operational Test and Evaluation (OT&E): Air Force Operational Test and Evaluation Center (AFOTEC) is conducting the IOT&E portion of the combined DT&E/IOT&E, dedicated IOT&E, and Phase I follow-on OT&E (FOT&E) of the HH-60.

(U) The IOT&E will address operational effectiveness and suitability objectives during DT&E/IOT&E flights. This testing began in May 1984 at Edwards AFB, CA. As the DT&E/IOT&E test program progresses, there will be an increasing emphasis on OT&E objectives which will be accomplished by the AFOTEC test team composed of AFOTEC, Military Airlift Command, Air Force Logistics Command and Air Training Command personnel. Of the 650 hours in the test program, approximately 314 hours will be dedicated to IOT&E. IOT&E is scheduled to be completed 31 December 1986.

Budget Activity: 4, Tactical Programs
Program Element: 64753F, HH-60A Program

(U) Phase I FOT&E will begin January 1987 and continue until delivery of the first production aircraft (approximately 21 months). This FOT&E will be used to evaluate correction of deficiencies identified during IOT&E, refine evaluations of operational effectiveness and suitability, evaluate tactics and techniques for combat rescue, and refine evaluations of aircrew and maintenance training requirements. Phase II FOT&E will be conducted by Military Airlift Command and monitored by Air Force Operational Test and Evaluation Center.

3. (U) Systems Characteristics:

Characteristic	Objective/Threshold	Demonstrated
Hover capability	Mid-mission hover out of ground effect at 4000 ft, 95°F	Mid-mission hover out of ground effect at 4000 ft, 95°F
Cruise speed	128 knots minimum at max continuous power	128 knots at max continuous power
Navigation accuracy	0.6 nautical miles per hour (without updates)	To be determined
Unrefueled mission radius	250 nautical miles	250 nautical miles

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Shakedown Tests	February-May 1984	February-May 1984	Sikorsky Flight Test Facility West Palm Beach, FL
Start of DT&E/IOT&E	1 June 1984	15 May 1984	Edwards AFB CA
Flight loads and vibrations	May-June 1984	May-June 1984	Edwards AFB CA
Aerial Refueling/Fuel System	July-August 1984	June-July 1984	Edwards AFB CA
High Altitude/Hot Temperature	July-August 1984	July-August 1984	Bishop CA
Performance and Handling Qualities	July-December 1984	July-October 1984	Edwards AFB CA

Budget Activity: 4, Tactical Programs
Program Element: 64753F, HH-60A Program

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Avionics Modification	December 1984-June 1985	IBM, Owego NY
Avionics DT&E/Shakedown	June-July 1985	IBM, Owego NY
Fuel Tank Jettison	September-October 1985	Edwards AFB CA
Combined DT&E/IOT&E (Avionics)	August 1985-June 1986	Edwards AFB CA

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64754F
DOD Mission Area: #343 - Theater Communications

Title: Joint Tactical Information Distribution System (JTIDS)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	45,540	86,511	91,675	60,334	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to develop a highly jam resistant, secure digital information distribution system for use in a tactical combat environment. The Joint Tactical Information Distribution System (JTIDS) is a joint development employing time division multiple access and spread spectrum techniques. The system will provide sufficient connectivity and capacity to permit rapid and secure exchange of the necessary command, control and status information among all equipped elements in the tactical theater.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	45,540	86,703	95,280		306,900	895,997
Aircraft Procurement						
E-3A (PE 27417F)	16,500	9,000	0		34,000	113,500
F-15 (PE 27130F)	0	3,100	54,400		TBD	TBD
Other Procurement						
Ground Terminal(PE 27434F)	21,026	28,051	18,041		TBD	118,580

- FY 86 RDT&E funding for F-15 Class 2 terminal integration design and kit development was adjusted to better phase development activities with anticipated production start.
- RDT&E Completion and Total columns changed to reflect anticipated future efforts.
- F-15 Class 2 terminal procurement changed to FY 1986 start deleting FY 1985 funds. Remaining years' funding adjusted to reflect change in delivered quantities.
- Ground Terminal procurement reduced in FY 1984/FY 1985 and deleted in FY 1986 to reflect change in required quantity from 24 to 19 systems. House Appropriations Committee reduced FY 1985 funding by additional $2.4 million, requiring a further reduction in quantity to 18 systems.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Aircraft Procurement: 1/						
E-3A (PE 27417F)	16,500	9,000	0	5,800	28,200	113,500
Quantities	10	5		8	26	34

Program Element: #64754F
DOD Mission Area: #343 - Theater Communications

Title: Joint Tactical Information Distribution System (JTIDS)
Budget Activity: #4 - Tactical Programs

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Estimated Cost
F-15 (PE 27130F)			0	49,300	TBD	TBD
Quantities				33	200	233
Other Procurement: 1/ Ground Terminal (PE 27434F)	16,226	25,651	0	0	0	93,362
Quantities	2	5				18

1/ Equipment only. Does not include spares.

5. (U) RELATED ACTIVITIES: The Joint Tactical Information Distribution System (JTIDS) development is managed by a jointly manned program office. Development, prototype fabrication, and test of terminal equipments for various applications of the services will be funded under this program element and will be conducted in conjunction with the other programs with which the equipments will ultimately be integrated.

6. (U) WORK PERFORMED BY: The Joint Program Office is located at the Electronic Systems Division, Hanscom AFB, MA. Work is also being done at the Aeronautical Systems Division, Wright-Patterson AFB, OH; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Initial system design and fabrication of prototype terminals for the E-3A were accomplished by Hughes Aircraft Company, Fullerton, CA, under a subcontract to the E-3A contractor, the Boeing Company Seattle, WA. Hughes began delivery of production units of the Class 1 terminal for the E-3A and the surface interface facilities in June 1982 (one month early). A firm fixed-price contract was let to Singer-Kearfott, Little Falls, NJ, for full scale development of the Class 2 terminal (Rockwell-Collins, Cedar Rapids, IA, is the second contractor in the leader-follower concept being pursued in this contract.). Other major contractors include: MITRE Corp, Bedford, MA, system engineering support; Singer-Kearfott, Little Falls, NJ, Advanced Development Model fighter class terminal; International Business Machines (IBM), Oswego, NY, surface terminal facility; McDonnell Douglas Aircraft Corp, St Louis, MO, fighter cockpit integration studies; and ARINC Research Corp, Annapolis, MD, design-to-cost studies.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64754F, Joint Tactical Information Distribution System

A. (U) Project Description: Currently, information upon which to base critical operational decisions normally exists somewhere within a combat area, but may not always be available to the force element needing the data.

Consequently there is an urgent requirement for a system that will distribute essential information to all elements of the force. The system must secure the message traffic, work in a severe jamming environment, and prevent hostile forces from intercepting and using the transmitted information. The Joint Tactical Information Distribution System (JTIDS) satisfies these requirements.

(U) The system will be structured to operate as an information distribution network into which tactical users transmit command and control, surveillance, position and status, or other significant combat information at specific time intervals. All of this information is immediately available to each net participant who may select for display or storage that portion of the information in which he/she is interested. The system will interconnect the E-3A aircraft; ground and shipboard command, control and surveillance centers; and combat and support aircraft.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Development of depot support equipment for the E-3A and ground terminal continued. Full scale development of the Class 2 terminal and conversion to the new message standard continued. The program was restructured to allow complete F-15/JTIDS flight testing prior to committing funds to the F-15 Class V (permanent) modification development program. At the direction of Congress, a report was prepared (and submitted) to detail the Air Force requirement for both JTIDS Class 2 terminals and the Enhanced JTIDS System, and the development plan for each.

(2) (U) FY 1985 Program: Continue development of depot support equipment for the E-3A/ground terminal. Continue full scale development of the Class 2 terminal. Begin development of a high-powered version of the Class 2 terminal for the E-3A and Modular Control Equipment (MCE). This is the means by which they will be converted to the new message standard, i.e., Tactical Digital Information Link "J" (TADIL J). These bilingual terminals will provide interoperability during the transition from the Interim JTIDS Message Specification (IJMS) to TADIL J. Initiate development of test equipment required for compatibility and interoperability testing with the other services. Initiate follow-on technology investigations.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Funds are provided for the completion of full scale development of the Class 2 terminal and for the conduct of flight tests in five F-15 fighter aircraft. Funds for the continued development of a high-powered version of the Class 2 terminal for the E-3A and Modular Control Element and development activities leading toward the conversion of these systems to the TADIL J message standard are provided. At this time we also anticipate beginning the development of kits and specialized test equipment for the integration of the Class 2 terminal into the F-15. Support for compatibility and interoperability testing with the other services will continue. Finally we will begin additional testing to obtain frequency support for higher operation transmission duty factors. The request is based on the January 1981 Defense Systems Acquisition Review Council (DSARC) II Milestone estimates and a fixed-price terminal development contract, as well as Program Office estimates of message standard conversion costs. The estimates are in the mature category (Confidence Level II).

(4) (U) Program to Completion: This is a continuing program. Complete development of depot support equipment for E-3A/ground terminals and development of the fighter terminals. Continue transition to the new message standard.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Waveform decision		February 1976
(2)	(U)	Initial E-3A Prototype Terminal Delivery		June 1977
(3)	(U)	Start Surface Terminal Development		June 1977
(4)	(U)	Start E-3A (Class 1) Terminal Low-rate Initial Production		July 1980
(5)	(U)	Start Fighter Terminal (Class 2) Full Scale Development		January 1981
(6)	(U)	Surface Terminal Long-lead Production Decision		December 1981
(7)	(U)	First Production Delivery of Class 1 (E-3A) Terminal		June 1982
(8)	(U)	First Surface Terminal Production Delivery		September 1984
(9)	(U)	Class 2 Terminal Production Decision	*(May 1986)	January 1987
	*	Date presented in Fiscal Year 1985 Descriptive Summary		

(U) EXPLANATION OF MILESTONE CHANGES

(9) Production decision slipped due to an additional delay in start of Development Test and Evaluation at Eglin AFB, FL.

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Joint Tactical Information Distribution System (JTIDS) program is developing a highly jam-resistant, secure digital information distribution system for use in a tactical combat environment. This joint development effort, managed by the Air Force Systems Command Electronic Systems Division at Hanscom Air Force Base, Massachusetts is a merger of the earlier efforts of Air Force (SEEK BUS) and Navy development programs.

(U) The feasibility of Time Division Multiple Access (TDMA) was demonstrated during the March 1973 E-3A brassboard flight test. Future tests will occur throughout the development cycle of each class of terminal.

(U) An extensive flight and bench test program to demonstrate compatibility with air traffic control equipments operating in the same portion of the frequency spectrum was conducted under the auspices of the Office of Telecommunications Policy, Executive Office of the President, in conjunction with the Federal Aviation Administration. These tests demonstrated that JTIDS can co-exist with the other systems in the band without harmful interference, and resulted in a frequency allocation for TDMA JTIDS. Further joint testing is planned to increase the allocation for TDMA operations. These tests will continue through 1985.

(U) Contractor flight tests of the Hughes Class 1 Advanced Development Model terminal on the E-3A aircraft evaluated net entry, synchronization, operation, and jamming margin. All specific operating parameters of the Class 1 terminal were met or exceeded in test programs in 1977 and 1978, but net management was assessed as time consuming. Since that time, a new net management time-slot assignment algorithm has been developed. Additional testing of the Class 1 full scale development model took place in September and October 1981.

(U) Additional testing in 1979 of the multipath propagation and doppler shift did not cause any degradation with the JTIDS terminal in the full anti-jam mode. Performance specifications were met under jamming conditions.

(U) During development flight tests at Eglin Air Force Base from November 1979 through October 1980, the Class 1 terminal was interfaced with the existing Tactical Air Control System through the Adaptable Surface Interface Terminal. Functional performance was successful, but reliability of the Class 1 terminal was below expectations. Further testing of Class 1 terminal reliability was accomplished during the September-October 1981 tests. The reliability during these tests was improved and overall suitability was rated satisfactory.

(U) Contractor acceptance testing of the Singer-Kearfott advanced development of a Class 2 terminal was completed late in 1978. The Naval Air Development Center completed bench and flight testing of this terminal in September 1979. Some net management, relative navigation, anti-jam, and Tactical Air Navigation (TACAN) system operations were deficient. Further testing was conducted during the pod-configured Class 2 Advanced Development Model tests from June 1981 to January 1982. The objective of packaging the functions in a fighter-sized terminal was met successfully.

Budget Activity: 4, Tactical Programs
Program Element: 64754F, Joint Tactical Information Distribution System

(U) Electromagnetic Compatibility testing has been accomplished in the United Kingdom and Germany to support frequency clearance in Europe. Based on this testing, Germany has granted a 100/50 clearance for NATO E-3A operations. Other Nations are expected to follow.

2. (U) Operational Test and Evaluation (OT&E): The purpose of Joint Tactical Information Distribution System (JTIDS) initial operational test and evaluation (IOT&E) is to evaluate the operational effectiveness and operational suitability of JTIDS terminals and the ability of the system to support both individual and joint service concepts in an operational environment. Testing of JTIDS has included multiservice (Army, Navy, Air Force, and Marine Corps) combined development test and evaluation (DT&E), IOT&E and service-unique testing. The Air Force Operational Test and Evaluation Center (AFOTEC) conducts IOT&E for the Air Force and is the lead agency for multiservice IOT&E. The other service operational test and evaluation (OT&E) organizations involved in JTIDS testing are the United States Army Operational Test and Evaluation Agency (USAOTEA), the Navy Operational Test and Evaluation Force (OPTEVFOR), and the Marine Corps Operational Test and Evaluation Agency (MCOTEA). The Air Force and Army are developing JTIDS terminals based on a time division multiple access (TDMA) technology. The Navy and Marine Corps are developing JTIDS terminals based on a distributed TDMA (DTDMA) technology. Operational test and evaluation of these two systems will be independent of each other with the exception of some limited interoperability testing in the mid to late 1980s.

(U) Test and Production Milestones:

E-3A/JTIDS advanced development model (ADM) terminal DT&E/IOT&E	May-June 1978
Adaptable Surface Interface Terminal (ASIT) full-scale development (FSD) terminal DT&E/IOT&E	November 1979-December 1980
ASIT operational suitability evaluation	May-December 1981
JTIDS Class 2 pod-configured ADM terminal IOT&E	June 1981-January 1982
US/NATO E-3A IOT&E	September-October 1981
ASIT long-lead production decision	December 1981
Class 2 (fighter) FSD TDMA terminal/F-15 DT&E/IOT&E	October 1985-October 1986
ASIT follow-on operational test and evaluation (FOT&E)	October 1985-May 1986
Class 2 TDMA terminal production decision	January 1987
Class 2 production TDMA terminal/F-15 integration FOT&E	1988/1989 time frame

An IOT&E of a TDMA JTIDS Class 1 ADM terminal installed in an E-3A was conducted during May-June 1978 by AFOTEC. Major emphasis was placed on assessing the resistance of JTIDS to electronic countermeasures (ECM). The test demonstrated the potential to greatly enhance digital information distribution. Problems associated with the establishment of the JTIDS net and net operations were identified during testing. The operational suitability could not be conclusively determined due to reliance on the contractor for system maintenance and support, the limited test period, and the small number of failures. AFOTEC recommended that further operational suitability testing of the JTIDS Class 1 terminal be conducted. The results of the E-3A/JTIDS IOT&E were reported in the AFOTEC E-3A Joint Tactical Information Distribution System (JTIDS) Terminal IOT&E Final Report (U), December 1978, SECRET.

Budget Activity: 4, Tactical Programs
Program Element: 64754F, Joint Tactical Information Distribution System

Additional testing of JTIDS in the E-3A was conducted between 15 September and 30 October 1981 using a preproduction Class 1 terminal. Eighteen sorties were flown. The test included the use of three Adaptable Surface Interface Terminals (ASITs) interfaced with both Army and Air Force ground command and control facilities. The test determined that JTIDS

However, it was determined that, as

Because the Class 1 terminal failed to meet the adjusted mean time between maintenance threshold, terminal reliability was rated deficient. Air Force Operational Test and Evaluation Center (AFOTEC) published the results of this test in an evaluation report titled US/NATO E-3A Initial Operational Test and Evaluation Final Report (IOT&E) (U), March 1982, SECRET.

(U) The ASIT provides a transparent interface between JTIDS equipped systems (such as the E-3A) and existing command and control systems which use Tactical Digital Information Link B (TADIL-B). The ASIT consists of two principal subsystems. One is a translator-processor (computer) which converts existing Tactical Air Control System/Tactical Air Defense System (TACS/TADS) messages passed over TADIL-B into JTIDS equivalent messages and vice versa. The second subsystem is the JTIDS Class 1 Terminal which performs signal transmission, reception, and related digital processing of the JTIDS signal.

(U) An IOT&E of three ASITs was conducted by AFOTEC, assisted by the Army and Marine Corps test organizations, in a multiservice combined DT&E/IOT&E at Eglin AFB, Florida from November 1979 to December 1980. Principal units/facilities to which the ASIT was interfaced are an Air Force Message Processing Center, an Air Force Control and Reporting Center, an Air National Guard Control and Reporting Post, an Army AN/TSQ-73 Air Defense Command and Control System, and a Marine Corps Tactical Air Operations Center. The ASIT IOT&E confirmed the results of the 1978 E-3A/JTIDS ADM terminal IOT&E that JTIDS provides a jam-resistant data link between the E-3A and ground command and control elements. The test also demonstrated JTIDS provides solid data-link communications that were relatively easy to establish and maintain. Although maintenance was done exclusively by contractor personnel with military personnel being limited to over-the-shoulder observation, overall operational suitability was found deficient. This was due to the low reliability of the JTIDS Class 1 terminal. Test results are documented in the Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal IOT&E Air Force Evaluation Report (U), March 1981, SECRET.

(U) A continuation of the operational suitability portion of the ASIT IOT&E was conducted by AFOTEC during May-December 1981. During the evaluation, the ASIT equipment (less the Class 1 terminal) was maintained by Air Force technicians. Because technical data and support equipment were not available for the Class 1 terminal, it was contractor maintained. The reliability of the Class 1 terminal demonstrated significant improvement over the results obtained during the original ASIT IOT&E. Overall suitability was found to be satisfactory. AFOTEC recommended a Final Operational Test and Evaluation (FOT&E) be conducted on an ASIT production terminal to assess the impact of the major changes in the terminal. The FOT&E is planned from October 1985 to May 1986 at Eglin AFB, Florida. The FOT&E wil be divided into three separate stages. First will be a period of reliability, availability, and maintainability (RAM) data collection which will begin with the turnover of the two ASITs to the 727th Tactical Control Squadron (test) and 728th Tactical Control Squadron. The second stage will consist of an interface test with the modular control equipment (MCE)

during the modular control equipment (MCE) Initial Operational Test and Evaluation (IOT&E). The final and most comprehensive stage will be the testing conducted during a portion of the Class 2 IOT&E from April to May 1986. Reliability, availability and maintainability (RAM) data will continue to be collected during stages two and three. Test results of the suitability evaluation are documented in the Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal Suitability Evaluation Final Report, March 1982.

(U) A preliminary evaluation of JTIDS in fighter aircraft was conducted between June 1981 and January 1982. A Singer-Kearfott AN/URQ-28 advanced development JTIDS terminal and associated support equipment were installed in an AN/ALQ-76 pod which is designed for use on Maverick-capable aircraft and makes use of existing controls, displays, and pylon interfaces. The pod was primarily designed to give early hands-on fighter experience with JTIDS. Three such pods were flown on F-4 and A-10 aircraft to evaluate the contribution of JTIDS in defensive counterair, close air support, and air interdiction mission roles. Fifteen JTIDS missions were flown during the test. The terminal demonstrated the potential to enhance mission effectiveness of fighter aircraft in the conduct of all three of these mission areas. Tactical situation awareness was improved through the use of JTIDS with a corresponding reduction in the need for voice communication. The JTIDS display provided the fighter crews with the same general air picture that was available to the controller in either surface or airborne command and control units. The enhanced situation awareness, displayed to the aircrews of the fighter aircraft, reduced the requirements for voice commands, attack vectors, and threat warnings. This, in turn, reduced the weapons controller workload. However, since the benefit of the JTIDS-display is primarily dependent upon the timeliness and accuracy of the information provided to the net, accurate tracking of hostile aircraft becomes essential. This requirement increased the surveillance operator workload when the auto-tracking feature of the Tactical Air Control System was degraded. Operational suitability was not evaluated during the test because there are no plans to produce a JTIDS terminal in a pod configuration. The test results were published in a test report titled Joint Tactical Information Distribution System (JTIDS) Class 2 Advanced Development Model Terminal (Pod Configuration Initial Operational Test and Evaluation Final Report (U), April 1982, CONFIDENTIAL.

(U) A multiservice Army and Air Force IOT&E will be conducted on a Class 2 FSD terminal internally installed in a temporary configuration on three F-15 aircraft and several Army air defense elements during 1986. In addition, the Class 2 will be installed as part of a permanent modification in two F-15C multistaged improvement program (MSIP) aircraft. The IOT&E will be conducted at Eglin AFB, Florida, and Nellis AFB, Nevada. The IOT&E will evaluate the contribution of JTIDS to the effectiveness of the F-15 in its air-to-air roles. Suitability data will be collected also. The IOT&E will consist of three stages. The first stage will consist of testing in the F-15 simulators at McDonnell Douglas facilities in St. Louis, Missouri, which will be modified to incorporate JTIDS. The second stage will be a flight-test stage which will be conducted at Eglin AFB and at the Tyndall AFB Air Combat Maneuvering Instrumentation Range. This stage will be used to test JTIDS Class 1 and Class 2 terminal interoperability and to gather data for evaluation of targeting efficiency and F-15 survivability. The final stage will consist of participation in a Green Flag operational exercise at Nellis Air Force Base. This will allow us to evaluate JTIDS in a more complex, target-dense environment. A production decision for the terminal will follow the test in January 1987. Assuming a favorable production decision for the terminal, a Final Operational Test and Evaluation of the permanent integration of the Class 2 into the F-15 in the 1987-1988 time frame may be conducted.

Budget Activity: 4, Tactical Programs
Program Element: 64754F, Joint Tactical Information Distribution System

(U) AFOTEC Test Reports on JTIDS are summarized below:

1. (U) E-3A Joint Tactical Information Distribution System (JTIDS) Terminal IOT&E Final Report (U), December 1978, SECRET.

2. (U) Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal IOT&E Air Force Evaluation Report (U), March 1981, SECRET

3. (U) US/NATO E-3A Initial Operational Test and Evaluation Final Report (U), March 1982, SECRET

4. (U) Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal Suitcbility Evaluation Final Report, March 1982, UNCLASSIFIED.

5. (U) Joint Tactical Information Distribution System (JTIDS) Class 2 Advanced Development Model Terminal (Pod Configuration) Initial Operational Test and Evaluation Final Report (U), April 1982, CONFIDENTIAL.

3. System Characteristics:

Characteristic	Objective	Demonstrated to Date
Frequency	960-1215 megahertz	960-1215 megahertz
Range	300 nautical miles (1200 nautical miles with relay)	300 nautical miles
Capacity	57.6 kilobits per second	57.6 kilobits per second
Users	2-2000	3
Message Error Rate	10^{-2}	10^{-2}
Anti-jam Margin	[ ]	[ ]
Range Accuracy	[ ]	To be determined

(U) Demonstrations of system characteristics are reported in the following test reports:

1. (U) E-3A Joint Tactical Information Distribution System (JTIDS) Initial Operational Test and Evaluation Final Report (U), December 1978, SECRET, Air Force Test and Evaluation Center, Kirtland Air Force Base, New Mexico 87117.

2. (U) Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal Initial Operational Test and Evaluation Air Force Evaluation Report (U), March 1981, SECRET, Air Force Test and Evaluation Center, Kirtland Air Force Base, New Mexico 87117.

3. (U) Joint Tactical Information Distribution System (JTIDS) Class 2 Advanced Development Model Terminal (Pod Configuration) Initial Operational Test and Evaluation (IOT&E) Final Report (U), April 1982, CONFIDENTIAL, Air Force Test and Evaluation Center, Kirtland Air Force Base, New Mexico 87117.

Budget Activity: 4, Tactical Programs
Program Element: 64754F, Joint Tactical Information Distribution System

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

None

T&E Activity (Next 12 Months)

Event	Planned Activity	Remarks
Start of Class 2 Development Test and Evaluation (DT&E)	October 1985	Slip in DT&E start from April 1985 to October 1985 is the result of problems experienced in the development of the Class 2 terminal
Start of ASIT Final Operational Test and Evaluation (FOT&E)	October 1985	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64756F
DOD Mission Area: #327 - TIARA for Tactical Air Warfare

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		26,939	24,547	20,667	11,992	Continuing	N/A
2037	SLAR Sensors	6,595	1,600	2,000	2,492	Continuing	N/A
2451	SLAR Exploitation	20,344	22,947	18,667	9,500	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This produot oriented Program Element develops radar sensors, processors, software, and exploitation equipment for use on reoonnaissance aircraft and in ground stations. Aircraft supported include the RF-4C, TR-1 and potentially the Advanced Tactical Airborne Reconnaissance System. The objective of this program is to develop and test advanced high resolution SLAR components and systems capable of collecting radar imagery of ground targets from an airborne platform, followed by transmission, processing, and exploitation of the imagery to yield reconnaissance and strike information during night and adverse weather conditions. Near real time SLAR imagery exploitation is performed in a ground processing station to achieve high resolution detection and to provide for[ ]of radar collection. Imagery-derived fixed target location[ ]reports are then sent to theater users including battlefield command centers, intelligence centers and strike systems such as the Combat Operations Intelligence Center, the Precision Location and Strike System and the Joint Surveillance and Target Attack Radar System.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	23,644	24,547	22,102		Continuing	N/A
Aircraft Procurement (PE 27215F)	41,800	61,100	0		0	150,400
Other Procurement (PE 27215F)	25,095	125,928	3,442		46,400	204,545

Aircraft Procurement (PE 27215F): In FY 85, $14.1 million was deleted due to repricing and a production profile change. In FY 86, $36.0 million was added to procure one radar and support equipment.

Program Element: #64756F
DOD Mission Area: #327 - TIARA for Tactical Air Warfare

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: #4 - Tactical Programs

Other Procurement (PE 27215F): The FY 84 reduction of $2.386M is the result of removing spares from this exhibit. In FY 85, $86.656M was deleted, moving ASARS exploitation equipment and spares procurement to FY 86. Again, spares funding is deleted from this exhibit. The FY 87 and Additional to Completion estimates complete procurement of TR-1 ground station components and refurbish the R&D functional prototype into an operational ground station.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Appropriation (PE 27215F)	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement (ASARS Radars)						
Funds	41,800	47,000	36,000	0	0	172,300
Quantities	(2)	(5)	(0)	(0)	(0)	(10)
Other Procurement (Ground Station Components)						
Funds	22,709	39,272	74,605	49,056	85,222	270,864
Quantities	(1)	(1)	(1)	(1)	(1)	(2 Gnd Sta)
Military Construction:						
Funds	0	0	19,380	18,011	24,338	61,729

5. (U) RELATED ACTIVITIES: Program Element 27215F, TR-1 Squadrons, procures operational Advanced Synthetic Aperture Radar System (ASARS) SLAR sensors and ground stations as funded by "other appropriations" above.

6. (U) WORK PERFORMED BY: This program is managed by Aeronautical Systems Division, Wright Patterson AFB, OH. Contractors for current efforts are: Hughes Aircraft Corp, Culver City, CA, develops the ASARS and ASARS Deployable Processing Station (ADPS); Ford Aerospace, Palo Alto, CA, is developing the Tactical Reconnaissance Exploitation Demonstration System (TREDS) and the production TR-1 Ground Station (TRIGS) to support TR-1 reconnaissance exploitation.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

Project: 2037, SLAR Sensors - The objective of this project is to develop the Advanced Synthetic Aperture Radar System (ASARS), ASARS Deployable Processing Station (ADPS), and Electronically Steerable Antenna. The radar system will provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other intelligence about targets under conditions in which non-radar sensors are ineffective. Operational requirements include near real time processing to achieve reliable detection[ ]if possible). The sensor includes search[ ]swath) and spot[ ]square patch) modes with resolution of[ ]respectively. The antenna will scan up to[ ]

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2451, SLAR Exploitation

A. (U) Project Description: The objective of this project is to develop and test SLAR exploitation components and systems. SLAR reconnaissance systems provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other useful intelligence about targets under conditions in which non-radar sensors are ineffective.

Operational requirements include near real time processing and exploitation (less than[ ]to achieve reliable detection,[ ]if possible) and location of fixed, mobile, moving, tactical size targets (Surface to Air Missiles, trucks, tanks) over wide areas[ ]swaths). To meet these requirements, advanced digital exploitation techniques will be used to enable a radar image analyst to identify targets on the display screen. This exploitation system will remedy the lack of near real time image exploitation capability in current operational SLAR systems and improve the timeliness of target reporting.

(U) The Advanced Synthetic Aperture Radar System (ASARS) is the operational sensor to be exploited. The development of the image exploitation/data handling segment for the ASARS system is the highest priority element of this project. This project includes development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) and design of the TR-1 Ground Station (TRIGS).

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: [ ]

(2) FY 1985 Program: The system will be shipped to Europe for integration with the existing [ ] TREDS will arrive at the deployment site [ ] On-site integration and checkout will complete [ ] will begin. The production TR-1 Ground Station (TRIGS) specification will be completed and design packages for TRIGS software will be prepared to match the results and recommendations of prototype TREDS testing in the United States. [ ] will be passed to the Program Office to ensure a high quality software product for TRIGS. This period of collection and analysis in TREDS is termed the [ ] Funding estimates as of November 1984, are based on the contractor's technical and financial performance since contract start in June 1981.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Results of prototype Tactical Reconnaissance Exploitation Demonstration System (TREDS) facility testing will be applied to the development of software for the production TR-1 Ground Station (TRIGS). TRIGS procurement was delayed from FY 85 to FY 86 to reduce the concurrency of testing the prototype TREDS and designing the TRIGS software packages. The current schedule allows for a full year of TREDS testing in Europe prior to TRIGS procurement.

(4) Program to Completion: From [ ] will be conducted in the TREDS, and the results will be applied to upgrade TREDS operational software and finalize TRIGS software packages. Following Initial Operational Capability (IOC), product improvements will be incorporated through [ ] to include electronic counter-countermeasures and interoperability with the RF-4C radar. The TRIGS production ground station will be deployed to a hardened site in Europe in FY [ ]

C. (U) Major Milestones:

	Milestones	Dates
(1)	Complete Preproduction Prototyping (TREDS Development)	[ ]
(2)	Initial Operational Capability (TREDS)	
(3)	Full Operational Capability (TRIGS) [	

* [ ]

Budget Activity: 4, Tactical Programs
Program Element: 64756F, Side Looking Airborne Radar (SLAR)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The SLAR system development is based upon a building block approach to providing a Tactical Reconnaissance System. The TR-1 Reconnaissance System (TRS) acquisition is a follow-on to the U-2R. Test and Evaluation plans and reports of completed evaluations are documented in special access programs and will be made available to appropriately cleared personnel. Tests on the Advanced Synthetic Aperture Radar System (ASARS) sensor began in fiscal year 1981. Tests on the ground processing and exploitation station are planned to complete in second quarter fiscal year 1985.

(U) The ASARS II development effort consists of two major projects managed by the Aeronautical Systems Division. One of these projects is with the Hughes Aircraft Corporation for development of an airborne sensor and a radar ground processor. The second project involves design of a ground facility to exploit ASARS imagery. Multiple program requirements are being addressed in these projects to meet the need for strategic/national and tactical SLAR collection, processing, timely exploitation and reporting during peace, crisis and war. Specific system requirements for the U-2R, and tests conducted on the U-2R, apply directly to the follow-on procurement of the Advanced Synthetic Aperture Radar System airborne and ground elements for the TR-1. These tests are documented in the Descriptive Summary for Program Element 64756F.

2. (U) Operational Test and Evaluation (OT&E): An OT&E of the SLAR collection and exploitation segments will be conducted in conjunction with the TRS OT&E. The purpose of the OT&E is to evaluate the aggregate system capability to provide near-real-time intelligence information to tactical commanders. See the TR-1 Squadron Congressional Data Sheet, Program Element 27215F, Budget Activity #4 - Other Aircraft for detailed information.

3. (U) Systems Characteristics:

(U) ADVANCED SYNTHETIC APERTURE RADAR SYSTEM (ASARS):

(U) Characteristic	Objective/Threshold	Demonstrated
Search Mode		
Range		
Swath Width		
Squint Angle		
Resolution		

Budget Activity: 4, Tactical Programs
Program Element. 64756F, Side Looking Airborne Radar (SLAR)

(U) Characteristic	Objective/Threshold	Demonstrated
Spotlight Mode		
Range		
Spot Size		
Squint Angle		
Resolution		

(U) TR-1 AIRCRAFT: All required operational characteristics verified by over 10 years of U-2R operation. Procurement organization will perform routine acceptance flight tests on each aircraft prior to delivery.

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

	Event	Planned Activity	Actual Date	Remarks
(U)	CONUS System D/CT&E	January-September 1984	January-December 1984	Development slipped 3 months

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64770F
DOD Mission Area: #217 - Land Warfare Surveillance & Reconnaissance

Title: Joint Surveillance and Target Attack Radar System (Joint STARS)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		40,991	46,682	260,221	210,075	TBD	TBD

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A critical need exists for an effective new capability to delay, disrupt, and destroy first and second echelon Warsaw Pact armored forces to hamper their use in breakthrough of Allied positions. Also, there is a critical need for a rapidly deployable, effective air-to-ground attack capability for use in less intense conflicts in contingency areas. To meet these needs, the Air Force and Army formed the Joint Surveillance and Target Attack Radar System (Joint STARS) as a high priority initiative, with Air Force lead.

(U) Joint STARS furthers the Assault Breaker concept: To delay/disrupt/destroy moving vehicles in the enemy second echelon. Joint STARS is unique in that it is a closed loop system for the real time detection, tracking, and attack of enemy ground movers. Utilizing Moving Target Indicator and Synthetic Aperture Radar techniques, Joint STARS can detect and track enemy forces. Via its control interfaces, Joint STARS integrates the accurate attack of those forces by providing guidance updates and exact enemy locations in real time to direct attack aircraft, friendly artillery, and stand-off missiles. In addition the Army Corps commander will use the wide area surveillance information for timely maneuvers of forces, battlefield management, and effective targeting of existing artillery and rockets.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	41,019	94,966	110,560		TBD	TBD
PE 27581F						
Aircraft Procurement	0	0	9,700		TBD	TBD
Other Procurement	0	0	9,969		TBD	TBD

(U) The FY 1984 RDT&E difference reflects funds reprogrammed for higher priority Air Force needs. The FY 1985 RDT&E difference reflects the amount appropriated by Congress. The FY86 differences reflect program restructuring based on the agreement of the Chiefs of Staff of the Army and Air Force, endorsed by the Deputy Secretary of Defense, that the C-18 aircraft will be the single airborne platform for Joint STARS, to meet Army and Air Force needs. The RDT&E increase reflects Air Force assumption of a greater share of total program cost. The procurement reduction better aligns production with the development schedule.

PE #: 64770F

Program Element: #64770F
DOD Mission Area: #217 - Land Warfare Surveillance & Reconnaissance

Title: Joint Surveillance and Target Attack Radar System (Joint STARS)
Budget Activity: #4 - Tactical Programs

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
PE 27581F						
Aircraft Procurement	0	0	0	0	TBD	TBD
Other Procurement	0	0	0	0	TBD	TBD

5. RELATED ACTIVITIES: There is no other system planned to provide closed loop target detection and tracking as well as real time guidance/cue-vectoring of attack platforms against second echelon armor. Currently, this mission is performed on[ ] The Joint STARS system will be the only DOD system able to direct attack aircraft or standoff missiles against moving ground targets from standoff ranges in real time.

(U) Program Element 63770F, Joint STARS Advanced Development, advances radar technology in areas closely coupled to the Joint STARS Full Scale Development program to reduce development risk and improve performance in such areas as target detection, accuracy, electronic counter-countermeasures and target discrimination. PE 63770F replaces the PAVE MOVER program element, PE 63747F.

(U) The Joint STARS Full Scale Development includes development and test of a weapon guidance capability for Tactical Aircraft. Using the Joint STARS radar as data link to a Weapon Interface Unit installed in tactical aircraft, the system will pass real-time target position updates to the test aircraft such as the F-16C/D and the F-15E. Program Elements 27133F, F-16 Multimission Fighter, and 27130F, F-15 Squadrons, are related to this effort.

(U) This Program Element replaced "PAVE MOVER Engagement System" (PE 64616F) and is closely coupled to Army PE 64770A, "Joint STARS". FY 1983 and FY 1984 funds were in PE 64616F.

6. (U) WORK PERFORMED BY: The Air Force is lead Service for the Joint Surveillance and Target Attack Radar System (Joint STARS). The Joint STARS Joint Program Office is at Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA, where a joint Army and Air Force program office guides the full scale development. A detachment of the Joint Program Office will operate from Ft Monmouth, NJ. The MITRE Corporation, Bedford, MA, assists the Joint Program Office in overall concept studies, test planning and evaluation of demonstrated results, preparation of technical specifications, technical analyses and advice. Independent test and evaluation will be under the direction of the Air Force Operational Test and Evaluation Center and the Army Operational Test and Evaluation Agency.

(U) Contractors for Full Scale Development will be chosen through a competitive source selection, now underway.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

Program Element: #64770F
DOD Mission Area: #217 - Land Warfare Surveillance & Reconnaissance

Title: Joint Surveillance and Target Attack Radar System (Joint STARS)
Budget Activity: #4 - Tactical Programs

(U) Project: 64770F, Joint STARS

A. Project Description: This project provides Full Scale Development of the Joint Surveillance and Target Attack Radar System (Joint STARS), a Army/Air Force program for an airborne radar and engagement system capable of detecting and tracking enemy ground movers,[ ]and of guiding accurate attacks against these targets using conventional weapons. The multi-function Joint STARS performs wide area battlefield surveillance, attack planning, attack control, and post attack assessment functions. The system includes a multi-mode radar, data links, and an operations and control system, all installed in a C-18 aircraft. The radar uses a large, electronically agile antenna to rapidly scan the areas of interest to the combat commander, using the Moving Target Indicator (MTI) mode. In time-shared fashion, the radar can interleave its Fixed Target Indicating (FTI) mode using synthetic aperture radar technology, and can provide real-time guidance updates to tactical aircraft and standoff missiles in flight. The radar is modular in design and is constrained in weight and volume to insure that it is readily adapted to use both the C-18 and in follow-on aircraft. The Operations and Control system includes the displays, computers, and weapon controllers used to exploit the wealth of radar data. Data links will transmit Joint STARS surveillance data omnidirectionally to combat commanders without delay. The C-18, a used Boeing 707-320 aircraft converted for military use, has been selected by the Chiefs of Staff of the Army and Air Force, and by the Department of Defense, as the single airborne platform for Joint STARS. The self-contained C-18 concept, with radar and operations/control capability in one aircraft, is particularly well suited to Rapid Deployment Joint Task Force (RDJTF) and contingency purposes. The target engagement capabilities of the Joint STARS system, based on technology demonstrated by the PAVE MOVER part of the Assault Breaker technology demonstrations, include cue vectoring of low altitude aircraft and relative guidance of standoff air-to-surface and surface-to-surface missiles.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: The PAVE MOVER program, which developed and evaluated the radars used in the Assault Breaker Technology Demonstration, was concluded, and test results were incorporated into the Joint STARS System Specification. The advanced development PAVE MOVER technology proved capable of detecting and tracking moving ground vehicles[ ]to ranges of[ ]degrees azimuth abeam of the aircraft. PAVE MOVER also demonstrated a small area[ ]fixed target image mode with [ ] resolution for the detection and location of stopped vehicles.

To provide a high probability of target destruction, the PAVE MOVER Engagement System used its narrow beam radar to send accurate guidance commands to standoff missiles and attacking aircraft. Total system strike accuracy using the PAVE MOVER relative guidance was designed for[ ] PAVE MOVER guided surface-to-surface missiles, in-flight, to highly accurate dispense points[ ]against fixed and moving armor at ranges of[ ] PAVE MOVER also cue-vectored a penetrating F-4 tactical aircraft on low altitude[ ]bombing runs against moving armor, with a CEP of[ ]

(U) The Air Force and Army harmonized their requirements and formalized them in the Joint Statement of Operational Requirements. The Chiefs of Staff of the Army and Air Force chose the C-18 as the single airborne platform for Joint STARS. With the Services in full agreement on requirements and choice of aircraft, Full Scale Development of the Ground

Station Module began. A revised System Specification was prepared, an acquisition strategy was reconfirmed, an Independent Cost Analysis was initiated, and competitive source selection of the Full Scale Development Prime Contractor began with the release to industry of the Request for Proposals.

(2) (U) FY 1985 Program: Formal Source Selection commenced with receipt of competitive proposals in November 1984. Contract award is anticipated in April 1985. In parallel with the source selection, joint service working groups will develop the Test and Evaluation Master Plan, the Integrated Logistics Support Plan, the Computer Resources Integrated Support Plan, and the other necessary foundations for a sound Full Scale Development. One contractor will be chosen to develop the airborne radar and other associated subsystems on the C-18 aircraft for joint use by the Army and Air Force. Included in the source selection is competitive development of a Surveillance and Control Data Link to interconnect the aircraft with ground stations. After contract award a series of design reviews will be held to insure that the technical approach is responsive to government requirements for a reliable, supportable system. Studies of integrated logistics support, joint training, basing concepts, and total systems effectiveness will be done. Modifications to the test aircraft will begin, brassboard subsystems will be developed, and components for subsystem build-up will be ordered. Interface work will continue, to insure interoperability across Services and related systems. The independent cost analysis will be completed and a Milestone II decision will be made.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Funds are requested for the first full year of Full Scale Development contract activity. Full scale development will proceed beyond the design phase, as brassboard hardware subsystems are developed, tested, and integrated. The C-18 aircraft will be refurbished, corrosion control and service bulletins will be accomplished, and air worthiness flight tests will commence. The off-the-shelf components of the operations and control system will be received, tested, and integrated into functional units. Software coding will begin and preliminary qualification tests and integration of selected modules will occur. Components of the communication subsystem will be received, inspected, and integrated into the test aircraft. Weapon Interface Unit design will be completed, fabrication and assembly will begin, and build-up of the modification kits for installing these units into the direct attack test aircraft will continue. Roof top tests of the first radar will begin, and the software development facility will be completed. Logistics trade-off analysis for repairs will be completed, and fabrication of support equipment and pre-operational spares will continue. Ground terminals of the Surveillance and Control Data Link will be integrated into the Ground Station Module which is being developed by Motorola under separate Army contract. Remaining off-the-shelf components and Government Furnished Equipment will be delivered in FY 1986. Cost estimates are Class III, based on parametric analysis and contractor prices furnished in a competitive environment.

(4) (U) Program to Completion: The Joint STARS program will complete full scale development for both Ground Station Modules and the airborne segment of C-18, radar, operations and control system, and data links to provide the earliest possible operational capability. Critical Design Reviews, Development and Initial Operational Test and Evaluation and Production Readiness Reviews will occur, and production of hardware will be completed. Follow-on Operational Test and Evaluation will be conducted on actual production equipment.

(U) As the Full Scale Development progresses, the interoperability efforts will focus on increasingly more complex and demanding scenarios, and will evaluate the Joint STARS system in a variety of modes, with emphasis on interface integrity and recovery from hardware/software/system failures, from enemy countermeasures and from the inevitable "fog of war." This project will continually examine any deficiencies of the man-machine or machine-machine interfaces as they are exposed in design reviews, analyses, test and evaluation, and independent audits. This work is key to the evolutionary nature of the Joint STARS system, and will continue so long as the program develops.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Release of Modified Full Scale Development Request for Proposals	*(2Q FY 1984)	September 1984
(2)	(U)	Contract Award for Full Scale Development	*(3Q FY 1984)	April 1985
(3)	(U)	Preliminary Design Review		November 1985
(4)	(U)	Critical Design Review		June 1986
(5)	(U)	Combined Development/Initial Operational Test & Evaluation Begins		October 1988
(6)	(U)	European Field Test Demonstration Begins		August 1989
(7)	(U)	Production Decision		October 1989
(8)	(U)	Initial Operational Capability (single-mode)	*(1988)	N/A
(9)	(U)	Initial Operational Capability (multiple mode)	*(1990+)	N/A

* Date presented in Fiscal Year 1985 Descriptive Summary.

(U) EXPLANATION OF MILESTONE CHANGES

(1) Original Request for Proposals was released in 2Q FY 1984, but was modified in September 1984 to incorporate changes based on the agreement of the Chiefs of Staff of the Army and Air Force that the C-18 will be the single airborne platform for Joint STARS. Source selection is now underway.

(2) Contract award, originally planned for 3Q FY 1984, was similarly delayed, and will occur in April 1985.

(8,9) The Initial Operational Capability (single-mode) previously described was based on the earlier program, which required separate installation efforts for the dissimilar TR-1 and OV-1 aircraft, and which could not have introduced the multiple modes required for Joint STARS into Europe until 1990+. The OV-1, which would have had only the basic Moving Target Indicating capability in it in 1988, has been replaced by the C-18 aircraft in the restructured program, as has the TR-1. The multiple-mode C-18 will be used in a European Field Test Demonstration in 1989. The date for Initial Operational Capability for the restructured program will depend on final force structure decisions.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64779F   Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)
DOD Mission Area: #344, Tactical Command and Control   Budget Activity: #4, Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		5,940	13,452	9,141	10,017	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: JINTACCS is a joint interoperability program to improve the operational effectiveness of service (Navy, Army, Air Force, Marine Corps) Tactical Command & Control Systems used in support of joint operations. Participating Air Force Systems are elements of the Tactical Air Control System (TACS), Tactical Air Intelligence System (TAIS), E-3A and Joint Tactical Information Distribution System (JTIDS). The JINTACCS program (formerly GAMO) is directed by Joint Chiefs of Staff memorandum (SM) 205-71 dated 1 April 1971, as modified by a Secretary of Defense memorandum, "Reorganization of the DOD Program to Achieve Interoperability of Tactical Command and Control Systems for Ground and Amphibious Military Operation (GAMO)," dated 2 Aug 1977. The program fulfills the requirements of Department of Defense Directive 4630.5, "Compatibility and Commonality of Equipment for Tactical Command and Control, and Communications." The structure of the program is established by the JINTACCS Program Summary which is reviewed and approved annually by Deputy Under Secretary of Defense Command, Control, Communications, and Intelligence (DUSD(C^3I)). Tactical Air Forces Required Operational Capability (TAF ROC) 306-74 (validated 4 Oct 74) is the requirement supporting JTIDS.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	5,410	13,452	9,342		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program element supports Air Force participation in the JINTACCS program with the Marine Corps, Navy, Army, and the Joint Tactical C^3 Agency which acts as the Executive Agent. Service and agency activities are governed by jointly agreed upon and Joint Chiefs of Staff approved documentation including Technical Interface Concepts and Technical Interface Design Plans. Close liaison across each of the Service JINTACCS programs precludes duplication of efforts. The Service related JINTACCS program elements/projects are: PE 64780M, Joint Interoperability Tactical Command Control System; PE 64779N, JINTACCS Program; PE 64779A, JINTACCS (including projects D298-JINTACCS Executive Agency NATO, D309-JINTACCS Army and D310 JINTACCS Executive Agent).

6. (U) WORK PERFORMED BY: The Tactical Air Force Interoperability Group (TAFIG) is coordinating and implementing authority for Air Force participation in the Joint Chiefs of Staff JINTACCS program. Research and development funds

management responsibility is assigned to the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. The Tactical Air Command provides operational support, including a Participating Test Unit at the Air Force Tactical Systems Interoperability Support Center at Langley AFB, VA, to support compatibility and interoperability testing and operational effectiveness demonstrations. The JINTACCS contractors are Systems Development Corporation, McLean, VA; Martin Marietta, Denver, CO; Cambridge Digital Systems, Inc., Cambridge, MA; and the MITRE C^3 Division, a Federal Contract Research Center, located at Bedford MA.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 64779F, Joint Interoperability of Tactical Command and Control Systems

A. (U) Project Description: Joint Interoperability of Tactical Command and Control Systems was started in August 1977 as the successor to the Ground and Amphibious Military Operation (GAMO) Program. Its purpose is to improve the operational effectiveness of the Service (Army, Navy, Air Force and Marine Corps) command and control systems used in support of joint operations through the 1980s. Also incorporated are the intelligence facilities of the National Security Agency and the Defense Intelligence Agency. Consideration of NATO interoperability was added in 1978. The Services and Agencies use the program to develop common interface standards and to modify their command and control equipment and procedures as necessary to insure systems interoperability, compatibility and operational effectiveness. To facilitate management, the program is divided into functional segments including intelligence, air operations, maritime operations, fire support, operations control and Tactical Digital Information Link "J" (TADIL J). Within the Air Force, the primary command and control facility interfaces to be analyzed and defined exist within the Tactical Air Control Center (TACC), Control and Reporting Center/Post, Direct Air Support Center, Airborne Warning and Control System, Airborne Battlefield Command and Control Center and the intelligence element supporting the TACC. An Air Force test facility identified as the Participating Test Unit has been identified to evaluate Air Force modified command, control and communications elements, to support testing and demonstrations, and to provide ongoing configuration control. The JINTACCS program follows a procedure where Technical Interface Concepts are defined and the initial Technical Interface Design Plans - Test Editions (TIDP-TE) are completed. Following modification of the test systems, Developmental Certification testing is performed, the TIDP-TE modified, Operational Effectiveness Demonstration conducted, and a final TIDP published for incorporation into Joint Chiefs of Staff publications. The overall goal is to achieve joint compatibility and interoperability among tactical command and control systems from each service.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Refined Technical Interface Design Plans. Began preparations for the FY 1985 Operational Effectiveness Demonstration. Supported the combined functional segment test of the JINTACCS technical design plans. Continued the upgrade of the JINTACCS Automated Message Preparation System (JAMPS). Continued Simulation Monitoring, Analysis, Reduction, Test System development for Langley AFB. Began an architecture study to examine Air Force systems which require a JINTACCS capability.

(2) (U) FY 1985 Program: Continue interface planning, analysis and design efforts as well as modification of test-only hardware and software. Support the Operational Effectiveness Demonstration for the Fire Support, Operations Control, Maritime Operations, Air Operations, and Intelligence segments. Upgrade the Tactical Intelligence Processing and Information system to a JINTACCS capability. Complete development of the JINTACCS Automated Message Preparation System (JAMPS). Continue configuration management testing of all existing and new segments. Continue planning for implementation of all approved functional segments. Complete the architecture study of Air Force systems which require JINTACCS capability. Continue the development of the Simulation, Monitoring, Analysis, Reduction and Test System (SMARTS) for Langley AFB and begin development of the SMARTS capability for Tinker AFB. Begin the upgrade of the Langley AFB Participating Test Unit (PTU) test bed to support Joint Tactical Information Distribution System (JTIDS) testing.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continue interface planning, analysis and design efforts during FY 1986 as well as modification of test only hardware and software. Start development of a multilingual JINTACCS Automated Message Preparation System (JAMPS) capability. Complete the development of the basic SMARTS capability at Langley AFB and Tinker AFB. Begin development of automatic message decomposition and data base update capability for JAMPS. Continue development of a Tactical Digital Information Link "J" (TADIL J) test capability for the Air Force PTU test bed. Estimates for the FY 1986 effort are based on the assumption that existing contracts for baseline systems will be extended to include additional design/development work. For SMARTS and PTU tasks these estimates are based on budgetary options to existing contracts (Cost estimating category III). For JAMPS upgrades, costs are based on engineering planning estimates (Cost estimating category IV).

(4) (U) Program to Completion: The technical interface design plans will be updated and subsequently incorporated as standards into appropriate Joint Chiefs of Staff publications. Operational configuration management testing will be conducted on a continuing basis. This is a continuing program.

C. (U) Major Milestones:

Milestones		Dates
(1) (U) Intelligence Operational Effectiveness Demonstration		May 1981
(2) (U) Air Operations/Intelligence Operational Effectiveness Demonstration		May 1983
(3) (U) Operations Control, Fire Support, Maritime Operations, Air Operations, and Intelligence Operational Effectiveness Demonstration		May 1985
(4) (U) JINTACCS Message Text Format Implementation		September 1986
(5) (U) TADIL J Development Certification Testing (DCT) start	*(September 1985)	January 1988
(6) (U) TADIL J DCT complete	*(December 1987)	December 1989

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) EXPLANATION OF MILESTONE CHANGES

(5) (U) Tactical Digital Information Link "J" (TADIL J) Development Certification Testing (DCT) start slipped to be compatible with availability of the Joint Tactical Command, Control, and Communication (C^3) Agency TADIL J test facilities.

(6) (U) TADIL J DCT completion date slipped to reflect date agreed to by the Joint Chiefs of Staff and projected by the Joint Tactical C^3 Agency.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27129F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: F-111 Squadrons
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		74,245	60,000	54,535	47,788	42,521	331,248
2056	PAVE TACK	251	100	6,400	2,400	0	23,965
2952	F-111 Avionics Intermediate Shop (AIS)	25,917	14,050	27,301	2,251	2,921	102,890
2962	F-111 Avionics Modernization Program (AMP)	48,077	45,850	9,900	300	0	111,022
3079	F-111 Digital Flight Control System (DFCS)	0	0	10,934	42,837	39,600	93,371

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for development activities associated with the F-111 aircraft. The first development activity is an enhancement to the PAVE TACK system. The objective of this project is to improve PAVE TACK's Night/Weather attack capability. The PAVE TACK Digital Infrared Detecting Set (DIDS) is a modification kit for the replacement of the current Forward Looking Infrared (FLIR) System's high failure rate subassemblies. It improves reliability and maintainability by reducing maintenance induced failures, decreasing the number of periodic adjustments and eliminating troublesome components. The second development activity is an engineering effort to replace the existing F-111 Avionics Intermediate Shop Automatic Test Stations which have become technologically obsolete, unreliable, and logistically unsupportable. The F/FB-111 Avionics Modernization Program is a reliability/maintainability improvement to the bomb navigation system required to reduce maintenance and support costs associated with high failure, high cost, and technologically outdated components. Finally, in FY 1986 an F-111 DFCS program will be a new project to correct problems with uncommanded flight maneuvers.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	75,240	71,942	46,259		TBD	TBD
Aircraft Procurement*	17,500	161,200	232,400		462,000	880,500

EXPLANATION: (U) FY 1985 decrease reflects Congressional FY 1985 reduction. FY 1986 increases and FY 1987 funding reflect the F-111 Digital Flight Control System (DFCS).
*Includes F-111 Avionics Modernization Program (AMP) kit costs only. Last year's Descriptive Summary inadvertently included BP1200 funds which are not part of this PE.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional To Completion	Total Estimated Cost
F-111 Avionics Modernization Program						
Aircraft Procurement (Kit Quantities)	17,500 (0)	161,200 (92)	234,100 (99)	284,900 (66)	299,800 (123)	997,500
F-111 Digital Flight Control System						
Aircraft Procurement (Quantity)					270,250 (TBD)	270,250

5. (U) RELATED ACTIVITIES: Not Applicable

6. (U) WORK PERFORMED BY: The FB-111 AMP contractors are General Dynamics, Fort Worth, TX; Texas Instruments, Dallas, TX; and General Electric, Schenectady, NY. The PAVE TACK contractors include Rockwell International, Anaheim, CA and Texas Instruments, Dallas, TX. The F-111 AIS contractors are Westinghouse, Baltimore, MD and Bendix, Teterboro, NJ. The F-111 System Manager is located at Sacramento Air Logistics Center, McClellan AFB, CA. PAVE TACK, DFCS and the FB-111 AMP (radar) development efforts are managed at Aeronautical Systems Division, Wright-Patterson AFB, OH. The F-111 AIS development effort is managed at San Antonio Air Logistics Center, Kelly AFB, TX.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2056, PAVE TACK. The Digital Infrared Detecting Set (DIDS) is a modification kit for the replacement of the current analog Forward Looking Infrared (FLIR) System's high failure rate subassemblies. The current FLIR requires extensive training and time to maintain due to its complexity. The DIDS replaces problem subassemblies with reliable solid-state electronics. This reduces required training, time consuming adjustments and maintenance induced failures. DIDS will not require as much training as the current analog FLIR because of its design. Some adjustments can be made external to the system, and it will have an expanded built-in test capability.

During FY 1984 DIDS brassboard flight testing was completed and data collection is being done on a brassboard at the Avionics Lab at Wright-Patterson AFB. A Request for Proposal for DIDS full scale development will be released during FY 1985. In FY 1985-1986 a contract will be awarded with the contractor defining the DIDS design and packaging concept and beginning the fabrication of full scale development DIDS units. These units will begin a reliability growth test during FY 1986. Emphasis is being placed on reliability testing because DIDS is a reliability/maintainability program.

B. (U) Project: 2962, F-111 Avionics Modernization Program (AMP). The F/FB-111 AMP is a low risk reliability/maintainability upgrade to the bomb navigation system of the FB-111, F-111 A/E/D/F, and EF-111. This modification involves the substitution, modification, and repackaging of 16 Line Replaceable Units (LRUs) in the following subsystems: Inertial Navigation System (INS), Terrain Following Radar, Attack Radar, Doppler Radar, Controls and Displays, and Data Transfer Unit. This modification is expected to raise the mean-time-between failure (MTBF) of the overall system from the current 5 hours to approximately 20 hours and will ensure system supportability into the 1990's In FY 1984 the three major contracts in the F/FB-111 AMP were awarded. General Dynamics performed the design, integration and preproduction tasks to incorporate mostly off-the-shelf Government Furnished Equipment (GFE) to replace low reliability equipment currently in the F-111 bomb navigation system. Midway through the period preliminary design reviews were completed, with critical design reviews of both aircraft software and hardware being successfully completed in July and September 1984, respectively. Software testing began with initial operational capability of the software test station on 1 Sep 1984. General Electric and Texas Instruments also completed all of their design reviews during the fiscal year. Initial breadboard hardware was put in test in August 1984 in preparation for initial prototype deliveries for test in early FY 1985. Materials for all prototype and preproduction items have been identified and placed on order. The Cockpit Review Team has identified all necessary changes for implementation. Test plans have been developed for a dedicated radar flight test in FY 1985. Provisioning activity has been initiated to ensure delivery of spares with production equipment. During FY 1985 the program will proceed to qualification testing of hardware and software in preparation for integrated flight test. Dedicated flight testing of the two radars will begin in April 1985 to isolate and correct any deficiencies in the radar equipment prior to integrated flight test in FY 1986. The complete trial installation kit will be incorporated into a Strategic Air Command (SAC) FB-111 for ground check. The FY 1986 program provides for completion of all AMP design activities and final software program refinement. Integrated flight tests will be performed and all design/deficiency changes completed. Test analyze and fix and combined environment/reliability testing requirements will be achieved. The funds required in FY 1986 are based upon firm fixed price contract negotiations and represent the last year of incremental funding. All design reviews will be completed and preproduction hardware will be under test. The first modified FB-111 will be delivered in December 1986.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2952, F-111 Avionics Intermediate Shop (AIS)

A. (U) Project Description: This project is driven by a need to replace the existing F/FB/EF-111 AIS test stations. These existing stations are obsolete, unreliable, and logistically unsupportable. The replacement

approach was chosen over other alternatives based on a 20-year life-cycle analysis which showed this to be the most cost effective solution. This development program will replace 292 test stations (27 different types) with 99 new technology computer controlled automatic test stations (4 different types) capable of supporting the 30 line replaceable units that make up the F/FB/EF-111 avionics baseline. These new stations will be delivered as 22 shop se[illegible] This development effort will make maximum use of existing hardware designs and of the test software and documentation already developed and in use with the existing AIS stations.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Design, engineering and integration of the test systems hardware and software continued. Development efforts for the balance of 78 FB-111 test program sets were initiated. Contract award for the EF-111A and F-111A/E test systems was accomplished and design and engineering activities commenced for 55 F/EF-111A/E test program sets (TPS).

(2) (U) FY 1985 Program: System integration, compatibility testing and field operational test and evaluation will be accomplished. The first AIS system will be delivered in the field to support Type I training in January 1985. Field qualification operational test and evaluation will commence during the third quarter FY 1985. The F/EF-111A/E TPS development will continue. Contract award for the F-111D/F and depot shops will be accomplished in FY 1985, and design and engineering efforts for 37 F-111D/F TPS will begin. Finally, a design and engineering effort will be started to identify and minimize impacts to the AIS as a result of the F-111 Avionics Modernization Program (AMP).

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Design, engineering, test and evaluation will continue for the F/EF-111A/E hardware, software and TPSs. Design and development activities will continue for F-111D/F hardware, software and TPSs. Design changes to accommodate F-111 AMP modifications will be finalized and implemented. FY 1986 shop deliveries are scheduled as follows:

1Q FY 1986	Air Training Command
2Q FY 1986	EF-111A, F-111A
3Q FY 1986	FB-111, F-111E and EF-111A
4Q FY 1986	F-111E

(4) (U) Program to Completion: Design and engineering for F-111D, depot shops and F-111 Avionics Modernization Program (AMP) modification impacts on hardware and software will be completed. Shop deliveries include:

1Q FY 1987	F-111F
2Q FY 1987	F-111D, Sacramento Air Logistics Center (ALC)
3Q FY 1987	F-111D, San Antonio ALC

Residual engineering and production tasks will continue until the final turnover of the last Avionics Intermediate Shop (AIS) in 2nd Q FY 1988 and all AMP design changes and retrofit actions are completed.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) First Delivery	Dec 1984
(2) (U) Begin Qualification Operational Test & Evaluation (QOT&E)	Jan 1985
(3) (U) Initial Operational Capability (IOC)	Mar 1986

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3079, F-111 Digital Flight Control System (DFCS)

A. (U) Project Description: The DFCS is a Class IVA safety modification that replaces the electronic portion of the F/FB/EF-111 flight control system with modern state-of-the-art digital computers and sensors. This project will also improve the critical interfaces the flight control system has with the on-board autopilot and the terrain following radar systems. As a by-product of this safety modification, the system reliability of the flight control system will be improved. The Strategic Air Command (SAC), Tactical Air Command (TAC) and United States Air Force Europe (USAFE) have identified this project as the number one F/FB-111 modification for an FY 1986 new start.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable

(2) (U) FY 1985 Program: Initiate project planning. Prepare a Request for Proposal and initiate source selection activities with the intent of awarding a full scale development (FSD) contract during FY 1986.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Award the FSD contract. Initiate the hardware and software system development as well as the necessary aircraft integration design effort.

(4) (U) Program to Completion: This is a continuing development effort leading to an FY 1988 production contract. First modified aircraft should be delivered during the second quarter of FY 1990.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Contract Award	3Q FY 1986
(2) (U) Critical Design Review	2Q FY 1987
(3) (U) System Flight Test	FY 1988
(4) (U) Start Modified Aircraft Deliveries	FY 1990

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27130F (including #27132F)
DOD Mission Area: #221 - Counter Air

Title: F-15 Squadrons
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		127,420*	189,592	252,142	110,305	68,905	3,004,464*
0131	F-15 Squadrons	110,005	105,092	143,542	43,005	52,805	2,710,549
0132	F-15E Unique Capability	17,415*	84,500	108,600	67,300	16,100	293,915*

* Includes 17,415 which was actually appropriated in PE #27132F in FY 1984 to initiate Derivative Fighter development.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The F-15 is a high performance, highly maneuverable fighter equipped with a long range look-down radar and a balanced mix of air-to-air weapons to provide an outstanding medium range all-weather and close-in visual kill capability. Designed specifically to gain and maintain air superiority, the F-15 has significantly upgraded United States Air Force Tactical Forces capability in the counter-air and air defense missions. Continued production of the F-15 satisfies force structure modernization and force expansion requirements and permits replacement of the aging F-106 in the Air Defense role. The F-15E (Dual Role Fighter) retains the basic air-to-air capability of the F-15A-D and adds the systems necessary to meet the urgent requirement for all weather deep penetration and night/under-the-weather air-to-surface attack. This program element now includes all tasks and funding previously identified under program elements (PE) 27130F and 27132F, Derivative Fighter.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E*	126,920	229,817	278,565		297,793	3,202,936
Procurement (Aircraft)*	1,526,200	2,240,100	2,821,900		18,361,200	38,219,800
Quantity	36	48	60		456	1356

* Includes both program elements 27130F and 27132F which are now combined in 27130F as directed by Congress based on the Dual Role Fighter decision.

(U) Congress directed an undistributed F-15 RDT&E reduction (-$40 million) in FY 1985. The FY 1986 RDT&E estimate decrease is due to a major restructuring of the total F-15 RDT&E effort since submittal of the FY 1985 Descriptive Summary. The decision to develop the F-15E as the Dual Role Fighter, the analysis of force structure and future mission

requirements in the Tactical Fighter Roadmap Plan, the decision to fund some efforts with RDT&E funds rather than procurement funds, and rephasing of $31.3 million of effort into FY 1986 as a result of the FY 1985 Congressional reduction, all affected the revised FY 1986 RDT&E estimate. The FY 1986 reduction includes movement of tasks previously estimated in the procurement account to RDT&E (+$41.0 million); engine integration, initiation of improved electronic counter-countermeasures (ECCM), enhancements to the inherent air-to-ground capability, and expanded weapons certification (+$65.2 million); difference between original Derivative Fighter effort and the effort required only to meet the unique mission requirements of the F-15E (-$135.6 million); and rephasing of the empennage improvements due to the Congressional reduction (+$3.0 million). The reduction in the total RDT&E estimated cost is the result of the same program restructure. Decreases in the procurement estimates for FY 1985 through completion reflect the F-15E procurement decision, the Alternate Fighter Engine decision, and the reduced procurement of F-15 aircraft as explained in the Tactical Fighter Roadmap.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	1,514,500	2,066,200	2,224,400	2,221,800	14,777,400	36,056,900
Quantities	36	42	48	48	336	1266

5. (U) RELATED ACTIVITIES: The Tactical Electronic Warfare System for F-15 application is being developed in Program Element (PE) #64739F, Tactical Protective Systems. AIM-9M and AIM-7M (Advanced Monopulse Seeker) air-to-air missiles are being procured for use on the F-15 and other aircraft under PE #27161F, Tactical Air Intercept Missiles. The Joint Tactical Information Distribution System (JTIDS) is being developed for use on multiple aircraft including the F-15 under PE #64754F, JTIDS. The Advanced Medium Range Air-to-Air Missile is being developed under PE #64314F. Generic radar algorithms, applicable to programmable signal processor radars, and computer software are being developed under PE #64201F, Aircraft Avionics Equipment Development, for possible use in the F-15 and other fighter aircraft. Capability is being developed under PE #64406F, Space Defense Systems, for designated air defense F-15s to support the air launched anti-satellite (ASAT) mission. The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) is being developed under PE #64249F, Night/Precision Attack.

6. (U) WORK PERFORMED BY: The F-15 development program is being managed by the F-15 Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. McDonnell-Douglas Corporation, St Louis, MO, is the prime contractor for development and production of the F-15 aircraft. Pratt & Whitney Division of the United Technology Corporation, West Palm Beach, FL, is the engine contractor. Hughes Aircraft Company, Culver City, CA, is the radar subcontractor to McDonnell-Douglas Corporation.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 0131, F-15 Squadrons

A. (U) Project Description: The F-15 is the most capable air superiority fighter in the world today. As such, it is the cornerstone to the accomplishment of all other tactical missions. With conformal fuel tanks, the F-15 can deploy worldwide with minimal tanker support and arrive in a combat ready configuration. However, the Soviet/Warsaw Pact threat continues to grow quantitatively and qualitatively; with their new generation of aircraft possessing all-weather detection and kill capabilities. To maintain the F-15's superiority against the threat in the mid 1980's and through the 1990's, avionics improvements are required. Avionics changes which exploit proven technological advances are being incorporated into the F-15 to provide expanded air combat capabilities. These improvements include expanded electronic counter-countermeasures (ECCM) and improved combat identification (ID) capability, updates to the electronic warfare suite, and incorporation of improved communications/identification equipment. In addition, this project develops enhanced capability for the secondary air-to-ground role. Improvements include a higher maximum takeoff weight, air-to-ground modes for the radar, an improved inertial navigation system, and increased capacity generators. These improvements are grouped into a comprehensive, cost effective Multi-Staged Improvement Program (MSIP).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: FY 1984 RDT&E funds were used to continue full scale development of the APG-70 radar, integration of radar Programmable Signal Processor (PSP) improvements in the APG-63, and flight testing of electronic warfare and weapons updates; to continue F-15/Advanced Medium Range Air-to-Air Missile (AMRAAM) integration and compatibility tests; and for management and engineering support. The following new efforts were initiated: air-to-ground radar modes, nine "G" capability, increased maximum takeoff gross weight, higher capacity generators, and development of MSIP simulator.

(2) (U) FY 1985 Program: The entire FY 1985 RDT&E program represents continuation of efforts that were begun in FY 1984 or earlier. Multi-Staged Improvement Program (MSIP) design, development and testing will be continued. Ground support equipment design and development will continue from its FY 1984 initiation. Flight testing efforts will continue for the Advanced Medium Range Air-to-Air Missile (AMRAAM) integration, MSIP radar testing and internal counter measures updates. Simulator software development to support MSIP aircraft capability improvements will also be programmed throughout FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 RDT&E program is absolutely essential to continue development and testing of the improvements initiated in FY 1985 and earlier. These improvements are required to meet the evolving air-to-air threat and to enhance the inherent air-to-ground capability of the aircraft The upgraded systems also serve as a baseline from which to add the unique systems needed only for the F-15E mission.

Planned efforts continue development and testing of the MSIP simulator, MSIP hardware and software, electronic counter-countermeasures, enhanced tactical electronic warfare system test equipment, and weapons certification for new weapons. The FY 1986 RDT&E request is based on grassroots estimates (Category I - comprehensive). An Independent Sufficiency Review completed in April 1984 found these estimates fully satisfactory.

(4) (U) Program to Completion: This is a continuing program. Program funding for FY 1987 - FY 1993 will support completion of tasks underway including radar improvements, air-to-ground improvements, added capability for electronic warfare test equipment, and additional weapons certification. Funding will also continue software update design and qualification, mission support, and flight testing for safety and operational deficiencies.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Advanced Development Initiated	January 1970
(2)	(U)	Initial Contract	January 1970
(3)	(U)	Critical Design Review	April 1971
(4)	(U)	Delivery, 1st Aircraft, 1st Flight	July 1972
(5)	(U)	Long Lead Production Decision	October 1972
(6)	(U)	Full Production Decision	February 1973
(7)	(U)	Initial Operational Capability	July 1975
(8)	(U)	Multi-Staged Improvement Program (MSIP) Initiated	June 1982
(9)	(U)	Planned Delivery, 1st MSIP Aircraft	June 1985

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 0132, F-15E Unique Capability

A. (U) Project Description: The F-15E (Dual Role Fighter) will be a high performance, highly maneuverable fighter equipped with a mix of air-to-air and air-to-surface weapons. The F-15E configuration is under development and will include missionized cockpits, Low Altitude Navigation, Targeting, and Infrared for Night (LANTIRN) capability, automatic terrain following/terrain avoidance (auto TF/TA), and other improvements. These improvements are necessary to fulfill an urgent need for an aircraft which retains basic air superiority capability, but can provide all weather navigation, deep penetration, and night/under-the-weather attack with large air-to-surface weapons payloads. This project completes development and testing of the changes required to meet the F-15E unique mission.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: This project was initiated in FY 1984 following the February 1984 decision to develop the F-15E. FY 1984 accomplishments include configuration development, cockpit design, and integration planning and design for new subsystems and weapons.

(2) (U) FY 1985 Program: Continue design, development, and testing associated with missionized cockpits to include a wide field of view head-up display (HUD), a remote map reader, and improved cockpit controls and displays; integration of Low Altitude Navigation, Targeting, and Infrared for Night (LANTIRN); development of automatic terrain following/terrain avoidance (auto TF/TA) capability using LANTIRN and a new digital flight control system; and expanded weapons integration. Initiate development of organizational and intermediate support equipment required to support new systems.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The entire FY 1986 RDT&E program is a continuation of the full scale development and testing of the F-15E systems, support equipment, etc., initiated in FY 1984. It funds instrumentation of test assets, continued software and hardware development and testing, and management and support of the F-15E effort. RDT&E efforts must be funded at this level to support the procurement of the eight F-15E aircraft in FY 1986. The FY 1986 RDT&E request is based on grassroots estimates (Category I - comprehensive). An Independent Sufficiency Review completed in April 1984 verified these estimates.

(4) (U) Program to Completion: The RDT&E program from FY 1987 - FY 1989 will complete this project. Tasks to be completed include final development and testing associated with F-15E subsystems and weapons integration shown above.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) F-15/F-16 Flight Evaluation Complete	June 1983
(2) (U) Statement of Need Validated	January 1984
(3) (U) F-15E Development Decision	February 1984
(4) (U) Award Development Contract	April 1984
(5) (U) First Aircraft Delivery	December 1986

Budget Activity: 4, Tactical Programs
Program Element: 27130F, F-15 Squadrons

Test and Evaluation Data

(U) The F-15 test program encompasses Contractor Development Test and Evaluation (CDT&E), Air Force Development Test and Evaluation (AFDT&E), Air Force Initial Operational Test and Evaluation (IOT&E) and Follow-on Operational Test and Evaluation (FOT&E). The purpose of CDT&E and AFDT&E was to provide necessary test and analysis data to assure that an operational air superiority weapon system would be available at the earliest practical time. Test objectives addressed compliance with specifications, established performance capabilities, evaluated handling qualities, etc. IOT&E was conducted throughout Development Test and Evaluation (DT&E) to evaluate the operational capability and suitability of the F-15 weapon system. A portion of Tactical Air Command's (TAC) IOT&E involved their participation in eleven F-15 Air Force Preliminary Evaluations (AFPE). Additionally, seven Initial AFDT&Es were conducted during DT&E to permit Air Force Flight Test Center and TAC pilots to evaluate contractor fixes of mandatory correction items discovered during AFPEs and to accomplish early Air Force developmental and operational test objectives. Eighteen F-15As and two F-15Bs (two-seat version) were dedicated to the DT&E/IOT&E tests.

1. (U) Development Test and Evaluation (DT&E): As of 30 Sep 84, the USAF and McDonnell Douglas DT&E test teams had accumulated 11326 test flights and 14243 flight hours on F-15 test aircraft during 145 months of F-15 DT&E. This paragraph summarizes the significant DT&E accomplishments in the F-15 program from the beginning of full scale development in Jan 70 through Sep 84. The air vehicle critical design review and the avionics equipment development review were completed in April and June 1971, respectively. From July 1971, efforts were directed to fabrication of components and flight test airplanes and extensive ground testing of subsystems. Three demonstration milestones were completed in February 1972, including the Engine/Inlet Compatibility Test, the Structural Test of Major Subassemblies, and the Engine Preliminary Flight Rating Test (PFRT) Milestones. To obtain increased engine efficiencies over the PFRT engine (Series I configuration) the Air Force decided, in March 1972, to use the alternate design being carried as a parallel effort. This engine became Series II, the configuration planned for Military Qualification Tests and for subsequent production. F-15 first flight occurred on 27 July 1972 beginning a highly successful flight test program. The flying qualities Air Force Preliminary Evaluation (AFPE) was completed in September 1972, with favorable results. The initial Airborne Avionics Performance Milestone was completed on 2 December 1972. Two structural demonstration milestones were completed in January 1973, including the Fatigue Test to One Lifetime and Static Test to Critical Conditions. The F100 engine endurance qualification test, delayed beyond planned completion date of February 1973 by technical problems, was successfully completed on 12 October 1973.

(U) All major structural testing milestones were met when the fatigue tests to three and four lifetimes were completed in March 1974. The Air Force Development Test and Evaluation (AFDT&E) began at Edwards AFB in February 1974. The external Stores Flutter Release Milestone was completed in August 1974. With the exception of a single aircraft conducting limited armament follow-on testing, all Contractor Development Test and Evaluation (CDT&E) was completed in November 1974. All high angle-of-attack and spin testing was completed in August 1975. The Equipment Qualified Milestone was completed in March 1977, and the Aerospace Ground Equipment In-Place Milestone

was completed in May 1977. Flight evaluation of the Air Intercept Missile Evaluation/Air Combat Evaluation changes to the computer software, F-15/F-16 radar mutual interference tests, and the AIM-9L integration effort were completed in 1978.

AFDT&E of the AN/ALR-56 Radar Warning Receiver "New Threat" program was completed and an interim flight test report published in 1978. The New Threats consisted of three major improvements. One feature allows the ALR-56 to sort out and analyze [ ] capability. A second modification gives increased capability to detect threats that are [ ] The final change, termed [ ] Successful operation of the [ ] was demonstrated. However, the software tape still had New Threat related problems as well as some carry-over deficiencies from the current Operational Flight Program. Further development and testing was required before release.

(U) The AN/ALR-56C Radar Warning Receiver update is a normal development program with Quick Reaction Capability (QRC) production acceleration. The update provides an expanded reception envelope to cover current threats and a fast timing receiver to detect new agile airborne interceptor (AI) threats. DT&E/IOT&E flight testing is scheduled for Feb 85 - Jul 85.

The AN/ALQ-135 Internal Countermeasures Set (ICS) update program is a QRC program to add a Band 3 jammer for Electronic Countermeasures against Compass Glory threats. This program replaces one of the existing Band 2 systems with a Band 3, thereby increasing frequency coverage of the ICS from the current system [ ] Upper hemispheric coverage and sophisticated jamming techniques are also included. Feasibility demonstration testing with a modified AN/ALR-56A RWR was completed in Jan 84. Combined DT&E/IOT&E of the system is scheduled to begin in Apr 85. This testing will initially be "stand alone" ICS testing and will evolve to an integrated test involving the AN/ALR-56C and AN/ALE-45 Countermeasures Dispenser. Target date for completion of the fully integrated Tactical Electronic Warfare System is Feb 86.

(U) In 1978, CDT&E and AFDT&E of the Jet Fuel Starter air start capability were completed. Testing under the F100 Engine Component Improvement Program, including solutions to the F100 stall/stagnation problem, continued throughout 1979 and 1980. The susceptibility of the F100 engine to compressor stalls followed by stagnations and the resultant durability problems have been areas of major concern. With incorporation of planned fixes, all of which have been tested, the current F-15 stall/stagnation rate of 1.0 incident per 1000 engine flight hours should be reduced. Development and test of the F-15 C/D model, Production Eagle Package 2000 improvement (2,000 lbs additional internal fuel, provisions for conformal fuel tanks and capability for higher takeoff gross weight), which was initiated in mid-1976, was completed in late 1980. Contractor Development Test and Evaluation (CDT&E) and Air Force Development Test and Evaluation (AFDT&E) of the C/D model, which began in February and May 1979, respectively, were completed in 1980.

(U) Finally, development and test of the programmable signal processor (PSP) for the F-15 radar, which began in 1978, continued through 1980. While containing some minor discrepancies, the first PSP operational flight program delivered in May 1980 was as good or better than current aircraft radar capabilities. The discrepancies were corrected with a tape revision in October 1980. The development of the Raid Assessment Mode (RAM) took longer than originally expected and was not incorporated until May 1981.

(U) The F-15 PSP Radar Improvement Program (PRIP) which began in June 1981 has been completed. The Engineering Change Proposal (ECP) 1518, Phase I DT&E at Edwards was initially completed 1 August 1983. This tape was released to Nellis AFB for Tactical Air Command Operational Test and Evaluation (TAC OT&E) and to St. Louis for production acceptance flights. Problems in the Phase I tape were identified during OT&E and McAir production acceptance flights. The tape was returned to DT&E. The problems were corrected and production incorporation of the Phase I tapes began in July 1984. ECP 1518 Phase II DT&E will be completed at Edwards AFB. The tape has been provided to TAC for OT&E. The Phase II tape release to TAF is scheduled for December 1984.

(U) The Derivative Fighter DT&E test program which began in November 1982 was completed in May 1983. The Derivative Fighter Flight Test Program involved four aircraft and accomplished initial air-to-surface stores carriage/separation, F-15 performance and flying qualities with conformal fuel tanks (CFT) and air-to-surface stores, avionics integration including high resolution radar, rear cockpit evaluation, weapons delivery and an operational utility evaluation. Because of high angle-of-attack (AOA) problems with CFTs, additional flights were required. The follow-on CFT high AOA flight test program was completed in July 1983 and the 30 units AOA restriction on CFT equipped aircraft in the air-to-air configuration was removed. With this restriction eliminated, AFOTEC re-flew the Derivative Fighter Air-To-Air Operational Utility Evaluation at Nellis AFB during June 1983. Heavy gross weight taxi testing was completed in August 1983. Initial BRU-26 flight tests were accomplished during the Derivative Fighter Flight Test Program and are continuing under Seek Eagle. Limited flight testing of tangential weapons carriage on CFTs was completed during August 1983. Verification of a significant drag reduction compared to the BRU-26 rack was accomplished.

(U) The F-15E test program is scheduled to begin in early 1985 with wind tunnel testing at Arnold Engineering Development Center (AEDC). The first flight testing is scheduled to begin in mid 1986 on the F-15C model loads and flutter test aircraft at Edwards AFB. The first F-15E flight test will begin in Jan 1987.

(U) Air Force Development Test and Evaluation (AFDT&E) Reports

1. May 75, AFFTC-TR-75-6, AFPE of the F-15 TEWS System
2. Jan 76, AFFTC-TR-75-32, F-15A Approach-To-Stall/Stall/Post-Stall Evaluation
3. Jul 76, AFFTC-TR-76-24, F-15 AFDT&E of Armament/Weapons Delivery System
4. Jul 77, AFFTC-TR-76-48, F/TF-15A Flying Qualities, AFDT&E
5. Jul 77, AFFTC-TR-77-7, F-15 Performance AFDT&E
6. Aug 77, AFFTC-TR-77-4, F-15 AFDT&E TEWS Evaluation

Budget Activity: 4, Tactical Programs
Program Element: 27130F, F-15 Squadrons

7. 6 Sep 77, Air Intercept Evaluation (AIMVAL) Vol I-VI by Rear Admiral Ernest E. Tissot, USN, and Major General James R. Hildreth, USAF.
8. Feb 78, ACEVAL/AIMVAL Joint Test Force, Nellis AFB Vol I-IV by Rear Admiral Robert P. McKenzie, USN, and Major General James R. Hildreth, USAF
9. 1 Apr 78, AFFTC-TR-77-40, F-15 AFDT&E Air-to-Air Missile Evaluation (AIM-9L)
10. 10 May 79, JFS Air Start Report AFFTC Directive 78-129
11. Nov 79, AFFTC-TR-79-21, F-15 APG-63 Radar, Hardware/Software Improvements
12. Dec 79, F-15 AFDT&E TEWS Phase III, AD-TR-79-84
13. Nov 80, AFFTC-TR-80-23, F-15C Flying Qualities, AFDT&E
14. Mar 81, Tape 066 OFP Verification AD-TR-77-4 (ALR-56)
15. Sep 81, AFFTC-TR-81-18, F-15C Limited Takeoff and Landing Evaluation
16. CIP Task 005, F-15/F-16 Flight Test (Engine)

(U) Contractor Development Test and Evaluation (CDT&E) Reports

1. 9 Nov 71, MDC A-1429, Static Test Results, Final Report
2. 6 Mar 72, MDC A-1595, F-15 Full Scale Inlet/Engine Compatibility Test
3. 7 Mar 72, MDC A-1601, F-15 Structural Utilization Report
4. 16 Mar 72, MDC A-1617, Milestone VIII, F-15 Avionics Integration Test Status
5. 28 Apr 72, MDC A-1688, Results of Fatigue/Static Test of F-15 Preproduction Design Verification (PDV-1) Wing Carry Through
6. 2 Aug 72, MDC A-1865, Final Report Propulsion Subsystem Endurance (pit 4 YF100 PW100 engine test)
7. Jan 73, MDC A-2104, F-15 Demonstration Milestone 10, Documentation Report - Initial Airborne Avionics Performance
8. 27 Feb 73, MDC A-2198, VOL I-VIII, F-15 Fatigue Tests-FTA 1 for fuselage and Cockpit Fatigue Test
9. 5 Jan 79, MDC A-5736, Test Program, JFS Airstart Capability in USAF airplanes, Flight Test Program, St. Louis, MO
10. 25 July 79, MDC A-6084, F-15C Final Flight Test Report
11. 9 Nov 81, MDC A-7436, Version Description Document, (Computer Program for F-15 Indicator Group) (PSDP Operational Flight Program)

2. (U) Operational Test and Evaluation (OT&E): Initial Operational Test and Evaluation (IOT&E): The F-15 IOT&E was part of a combined IOT&E/Air Force and contractor Development Test and Evaluation (DT&E) conducted at Edwards AFB, California, using data from contractor and Air Force DT&E sorties flown July 1972 through 30 June 1975. The IOT&E was USAF directed, Tactical Air Command conducted, and Air Force Test and Evaluation Center (AFTEC) monitored. The IOT&E provided estimates of system operational effectiveness and suitability in support of Defense Systems Acquisition Review Council (DSARC) decisions related to increased production rate. Specific test objectives addressed both air-to-air and air-to-ground mission roles. In the 2.5 year effort 4460 sorties were flown. The aircraft was found to have superior handling and flight characteristics in the air-to-air regime. Likewise the F-15 was shown to be an effective

platform for air-to-ground ordnance delivery. The continual change of hardware and software throughout the test program precluded establishment of a reliability assessment data base. The immaturity of built-in test (BIT) and the absence of major test equipment items were limiting factors in the overall suitability evaluation.

(U) Follow-on Operational Test and Evaluation (FOT&E): The F-15 FOT&E was an independent test and evaluation managed by the AFTEC and conducted by the AFTEC test team at Luke AFB, Arizona. The objectives of FOT&E were to verify the operational effectiveness and suitability, which included assessment of the logistical supportability, life cycle costs, and identification of desirable modifications or trade-offs for the production F-15 system. The FOT&E commenced in March 1975 and finished in July 1976 using a total of 1111 F-15 sorties and approximately 900 support sorties. Evaluation sorties were flown by AFTEC and Tactical Air Command pilots. Once again, the F-15 was found to be an excellent weapons system for air-to-air combat. Several deficiencies were noted, but the F-15 Program Office has since corrected them. Test estimates of reliability/maintainability indicated that the F-15A will be malfunction free on 20 percent of the sorties and generally have the capability to turn for a second mission 50 percent of the time. The manpower requirements necessary to support a 72 aircraft wing were estimated at approximately 1000 authorizations.

(U) In addition to the above testing, an Initial Operational Test and Evaluation (IOT&E) of the F-15 Tactical Electronic Warfare System (TEWS) was conducted by the US Air Force Tactical Air Warfare Center (USAF TAWC), Eglin AFB, Florida. TEWS gives the fighter pilot an EW capability far superior to that of previous EW systems. The resources of the Armament Development and Test Center, the Naval Weapons Center, and the 6512 Test Squadron, Air Force Systems Command were used during the test. The test was conducted simultaneously with Air Force and contractor Development Test and Evaluation (DT&E) from February 1974 through October 1976. The IOT&E which was Air Force directed and Air Force Test and Evaluation Center monitored, was comprised of 325 sorties. Air Force personnel performed organizational level maintenance for the F-15 TEWS. However, intermediate and depot maintenance support was accomplished entirely by contractor engineers and technicians using interim special test equipment.

(U) An IOT&E of the Overload Warning System (OWS) was conducted by the US Air Force Tactical Fighter Weapons Center (USAFTFWC), Nellis AFB, Nevada. The OWS should reduce F-15 airframe damage resulting from flight overload situations as well as permitting more effective employment of the F-15. The OWS IOT&E report was released in March 1981. Production incorporation began with the FY80 buy, and the first aircraft was delivered in December 1981.

(U) The Air Force Operational Test and Evaluation Center (AFOTEC) participated in a combined DT&E/OUE of the F-15 dual-role fighter (DRF) from August 1982 through April 1983 at Edwards AFB, California. AFOTEC testing emphasized air-to-surface mission capabilities. Effectiveness data were collected on 49 dedicated OUE sorties. Suitability data were collected on 151 combined DT&E/OUE sorties. The prototype F-15 DRF demonstrated a significant improvement over the F-15 aircraft baseline in range and payload for all configurations flown. Performance and handling, in both air-to-surface and air-to-air combat operations, were equal to or better than the baseline when the conformal fuel

tanks were empty. The F-15 DRF could be flown effectively at its maximum gross weights and configurations, but predictably, its maneuverability was slightly degraded. Overall, the aircraft has improved air-to-surface operational capabilities while retaining its basic air superiority capability.

(U) Operational Test and Evaluation (OT&E) Reports

1. F-15A Initial OT&E Final Report, January 1976 (U)
2. F-15A Follow On OT&E Final Report, August 1976 (U)
3. F-15 TEWS IOT&E Final Report, January 1977 (U)
4. F-15 Verification T&E in Europe, July 1977 (U)
5. F-15 Tactical Electronic Warning System, December 1979 (U)
6. F-15 Overload Warning System, March 1981 (U)
7. F-15 Improved Radar QOT&E Final Report, July 1981 (U)
8. F-15 DRF OUE Final Report, November 1983 (S)

3. (U) Systems Characteristics: The F-15 is an advanced tactical fighter developed for the air superiority mission. It is a twin engine, single place, fixed swept wing airplane characterized by high thrust-to-weight and low wing loading for superior acceleration and maneuverability. The F-15 is equipped with a balanced mix of air-to-air weapons, ranging from medium range all-weather missiles to rapid-fire 20mm cannon and provides an outstanding capability against the postulated enemy air threat.

A. (U) Operational	DEVELOPMENT ESTIMATE	DEMONSTRATED PERFORMANCE
1. (U) Max Mach No @ Altitude (Sustained/Burst)	2.3/2.5	2.3/2.5
2. (U) Max Mach No @ Sea Level (Sustained)	1.2	1.16
3. (U) Design Maximum Load Factor (80% Internal Fuel), g	7.33	7.33
4. Maximum Buffet-Free Maneuver g (0.8M, 30K ft), g	[	]

Budget Activity: 4, Tactical Programs
Program Element: 27130F, F-15 Squadrons

	DEVELOPMENT ESTIMATE	DEMONSTRATED PERFORMANCE
A. (U) Operational (continued)		
5. (U) Energy Maneuverability (Ps), fps		
a. 0.9M, 30,000 ft, 5g, Mil Pwr		
b. 0.6M, 10,000 ft, 5g, Max Pwr		
c. 0.9M, 10,000 ft, 1g, Max Pwr		
d. 0.9M, 10,000 ft, 5g, Max Pwr		
e. 0.9M, 30,000 ft, 5g, Max Pwr		
f. 0.9M, 35,000 ft, 5g, Max Pwr		
B. (U) Technical		
1. Design Mission Takeoff Wt, lb	40,000	41,491
2. Takeoff Wing Loading, lb/ft	66	68
3. Uninstalled Thrust-to-Takeoff Weight Ratio	1.17	1.15

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
APG-70 Radar Preliminary Design Review (PDR)	June 1983	June 1983	
Central Computer (CC) Critical Design Review (CDR)	September 1983	September 1983	
First MSIP Flight	December 1983	December 1983	

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
MSIP Radar Flight Test (APG-70 Hardware)	November 1984	
APG-70 Radar CDR	December 1984	Originally October 1984
F-15E Wind Tunnel Test	January 1985	
MSIP/AMRAAM FSD Flight Test	March 1985	
ALQ-135 Flight Test	June 1985	
ALE-45 Phase III Flight Test	October 1985	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27131F
DOD Mission Area: #223 - Close Air Support/Battlefield Interdiction

Title: A-10 Squadrons
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimate Cost
TOTAL FOR PROGRAM ELEMENT		3,639	3,108	3,102	0	0	491,473

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The A-10 is a single seat aircraft specifically designed for the Close Air Support (CAS) mission. High survivability is a primary design feature. It has a high velocity, rapid fire, 30 millimeter(mm) gun for increased target kill effectiveness and can carry a large and variable external load of conventional ordnance. The A-10 is designed to operate in the European threat environment, and its primary mission is to attack targets in close proximity to friendly forces in support of the ground battle.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimate Cost
RDT&E	2,639	4,108	3,170		0	491,786

(U) FY 1984 RDT&E increased $1.0 Million by reprogramming to accomplish a follow-on Close Air Support study.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: The A-10 uses the General Electric TF34-100 engine which is a modification of the TF34-400 engine developed by the Navy for the S-3A (Anti-Submarine Warfare Aircraft), Program Element (PE) 24215N. The A-10 Program Office and Navy have worked closely to ensure a high degree of commonality between both engine models. The A-10 is the first weapon system to use the GAU-8 30mm gun system, developed under PE 64605F. The A-10 Program Office had overall management responsibility for the GAU-8. The cost of the gun development as related to integration and testing with the A-10 was borne by the A-10 element. The A-10 also employs the Maverick AGM-65 (Tactical Air-to-Ground Missile), PE 27313F. Weapon System Trainers for the A-10 were developed in PE 64227F (Flight Simulator Development). The Standard Inertial Navigation System, developed under PE 64201F (Aircraft Avionics Equipment Development) is being installed in the A-10. The $14.9 million for PE 64201F is not shown although the A-10 Selected Acquisition Report had included these costs in the A-10 development. The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) being developed under PE 64249F is planned for integration on the A-10 by a Class V Aircraft Modification.

6. (U) WORK PERFORMED BY: The prime contractor for the A-10 is Fairchild Republic Company, Farmingdale, LI, NY. The A-10 is currently managed by Sacramento Air Logistics Center, Sacramento, CA. The GAU-8 30mm gun contractor is General Electric, Burlington, VT. The gun is managed by Warner-Robins Air Logistics Center, Robins AFB, GA. The engine contractor is General Electric, Lynn, MA. The TF34-100 engine is managed by the San Antonio Air Logistics Center, Kelly AFB, TX.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 27131F, A-10 Squadrons

A. (U) Project Description: The A-10 RDT&E program now provides minimum sustaining flight test, laboratory and engineering support to resolve service revealed problems and to evaluate potential avionics enhancements to increase effectiveness and survivability.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: RDT&E efforts continued at a modest level to resolve service revealed problems including investigation of oil cooler efficiency and aft gun mount galling. Additionally, efforts continued to complete qualification of the Intermediate Avionics Test Station (IATS). To address a high priority safety issue, an evaluation of a potential Ground Proximity Warning System (GPWS) was begun. Finally, a countermeasures study effort was completed on a missile warning system which could be used to cue the ALE-40 flare/chaff system to provide automatic countermeasures dispensing.

(2) (U) FY 1985 Program: The FY 1985 RDT&E efforts will continue minimum support for resolving service revealed problems and for evaluating avionics improvements to increase the A-10's effectiveness. The IATS qualification will be completed. Testing of the off-the-shelf GPWS will be continued, and an alternative system will also be evaluated. As a follow-on to the 1984 missile warning system study, a flight evaluation of the ALQ-156 missile warning system will be performed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Requests: RDT&E efforts related to the original development program will be completed, including all residual development tasks identified by the transfer of program management responsibility from the A-10 System Program Office to Sacramento Air Logistics Center. Development efforts on missile warning and ground proximity warning will be completed.

(4) (U) Program to Completion: The FY 1986 efforts will complete the planned development program.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Award Full Scale Development contract	March 1973
(2) (U) Critical Design Review	May 1974
(3) (U) GAU-8/A prototype demonstration complete	May 1974
(4) (U) Production Readiness Review	May 1974
(5) (U) DSARC IIIA & long lead production release	July 1974
(6) (U) Engine qualification test complete	October 1974
(7) (U) First development flight	February 1975
(8) (U) Fatigue test one lifetime complete	October 1975
(9) (U) First production aircraft delivery	November 1975
(10) (U) DSARC IIIB production decision	February 1976
(11) (U) Initial Operational Capability	October 1977
(12) (U) Activate first European base	January 1979
(12) (U) Final aircraft delivery	February 1984
(13) (U) Complete follow-up development program	September 1980

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable.

Budget Activity: 4, Tactical Programs
Program Element: 27131F, A-10 Squadrons

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): In 1966, the Chief of Staff of the Air Force directed that action be taken to develop a new aircraft specialized for the Close Air Support (CAS) mission. This direction reflected the need for an aircraft which would replace aging or less effective aircraft used in CAS and to provide optimum CAS at least cost. This requirement still exists and is being satisfied by the A-10. The development of the A-10 was initiated, using a competitive prototype approach, with "design-to-cost" management goals. On 28 February 1973, the Department of Defense approved the development of the A-10 and the Air Force Systems Command awarded contracts to Fairchild Republic Company (airframe) and General Electric Company (TF34 engine) for this effort.

(U) An extensive review of the A-10 program was accomplished in July 1974 to determine if the A-10 was ready to enter low rate production. A detailed assessment of the test program and a review of the A-10's production readiness posture were made. The results of this review culminated in the approval to procure 52 A-10 production aircraft.

(U) The TF34-100 engine completed qualification testing in October 1974. Continued testing of the two prototype aircraft until June 1975 supported the development program. Six Development Test and Evaluation (DT&E) aircraft were delivered in February 1975. These aircraft were used to test the following areas: aerodynamics, performance, freedom from flutter, 100 percent air loads, armament systems, subsystems, climatic/adverse weather testing and initial operational tests. The performance thresholds were met or exceeded with the exception of forward airstrip takeoff and landing distance. These parameter values were assessed and found to have little impact on the A-10's operational utility. All major test milestones required prior to the full rate production decision were accomplished. The bomb and strafe accuracy tests demonstrated the A-10's excellent weapon delivery capability. The A-10 technical risks were minimized prior to production go-ahead.

(U) The static test article has successfully demonstrated freedom from permanent deformation at design limit load and the ability to withstand ultimate strength (1.5 times limit load). The A-10 was certified to 6000 hours service life in May 1976; however, current operational usage is more severe than originally forecast resulting in a service life of 4500 hours. The cold working of approximately 1400 fastener holes in the center wing section was required to achieve 6000 hours based on the current, more severe operational usage. Three fatigue test failures following the certification confirmed the cold work of the fastener holes in the center wing section and resulted in a decision to thicken the outer wing section skin panels to extend the wing life to 8000 hours. A wing-only fatigue test resumed in March 1982 with one side representing the thicker production wing and the other side the thicker retro-fit wing. This testing validated an 8000 hour service life with the more severe operational usage.

(U) In June 1978 and again in the summer of 1979, engine rollbacks during gunfiring were experienced. An extensive flight test investigation was initiated and interim and permanent solutions were developed. The interim solution provides continuous engine ignition whenever the gun is fired. Continuous engine ignition and regularly scheduled engine water washings have eliminated engine disturbances during gunfiring. Several solutions which divert hot gun gases away

from the engine were tested. The final selection of one solution for incorporation on all A-10s is a Battelle design which attaches to the end of the barrels.

(U) Follow-on Development Test and Evaluation (DT&E) of selected enhancements (internal chaff/flare, inertial navigation system, improved radar warning and night/low altitude avionics) has been accomplished. The DT&E aircraft have been modified to a logistics supportable configuration. These aircraft will be used within Air Force Systems Command for follow-on testing requiring the use of A-10 testbed aircraft.

(U) In preparation for FY 1983 procurement, DT&E began in August 1981 on the two-seat trainer aircraft which was to be designated the A-10B. Preliminary testing investigated the height of the vertical tail needed to maintain the same handling characteristics as the single seat A-10A. Two-seat development was terminated in September 1982 following deletion of authorization for A-10 procurement in the FY 1983 Authorization Act (16 August 1982).

(U) The FY 1983 procurement was not authorized by Congress. The 707th and final production A-10 was delivered in February 1984.

(U) In response to a validated Tactical Air Force (TAF) Statement of Operational Need, 311-82, a flight demonstration of a commercial off-the-shelf Ground Proximity Warning System began in May 1984. This testing will be followed by a DT&E of a generic Ground Collision Avoidance System in February through May 1985.

2. (U) Operational Test and Evaluation (OT&E): Phase I Initial Operational Test and Evaluation (IOT&E) of the A-10 was conducted in conjunction with Development Test and Evaluation (DT&E) of the prototype YA-10 aircraft from March 1973 through June 1975. Phase II IOT&E, using six preproduction aircraft and later three production aircraft, began in April 1975 and was completed in March 1976. Limited aircraft availability prohibited evaluation of multiship employment concepts and tactics; however, adequate data were available to make an assessment of the A-10A aircraft.

(U) The combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) for the preproduction aircraft was conducted at the Edwards AFB, George AFB, and Nellis AFB ranges. An Air Force Test and Evaluation Center (AFTEC) test team composed of personnel from AFTEC, Tactical Air Command, Air Force Logistics Command, and Air Training Command conducted the IOT&E portion of the test. The purpose of the IOT&E was to evaluate the operational suitability and operational effectiveness of the A-10 preproduction aircraft. Missions were flown to evaluate the aircraft, airborne performance, and handling qualities; pilot workload; air refueling capability; weapons delivery accuracy; defensive combat maneuvering capability; and night/weather operations. In addition, the close air support missions (support of troops, convoy escort, preparatory attacks, armed reconnaissance, and combat search and rescue) were evaluated. The interface of the GAU-8 gun with the A-10 was a primary objective. Data were gathered and analyzed to evaluate the A-10 survivability, reliability, maintainability, logistic supportability and maintenance training requirements.

Budget Activity: 4, Tactical Programs
Program Element: 27131F, A-10 Squadrons

(U) Follow-on Operational Test and Evaluation (FOT&E) was accomplished in two phases. Phase I, conducted by the Air Force Test and Evaluation Center (AFTEC) and the 355th Tactical Fighter Wing, commenced in August 1976 and was completed in February 1977. This phase involved six production aircraft flying 388 sorties. Test location was Davis-Monthan AFB with deployments to Nellis AFB and McChord AFB for accomplishment of surge and low visibility test objectives. Based on the results of phase I FOT&E, AFTEC concluded that the production A-10A could perform the close air support mission better than any existing aircraft in the USAF inventory. Although some aircraft performance thresholds were missed, the overall performance was satisfactory in the context of tailoring loads and tactics to the specific missions. Primary weapons include the AGM-65 Maverick missiles and the 30mm gun. The 30mm gun is a superior weapon when attacking current and projected Warsaw Pact front line armor. Excellent accuracy is achieved even when firing beyond 4000 feet slant range.

(U) Lack of sophisticated avionics has relegated the aircraft to daytime usage in a high threat environment. With low altitude target ingress, dead reckoning navigation caused an excessive pilot workload. Therefore, an inertial navigational system (INS) was introduced starting with production aircraft number 431. A retrofit program for all A-10 aircraft has been approved. In the low ceiling/visibility environment, the aircraft's capability to attack small passive targets is unmatched by any other aircraft in the inventory.

(U) The A-10A is well suited to forward operating locations. Medium weight takeoffs and landings resulted in average distances of 2175 feet and 1600 feet, respectively. The simplicity of the aircraft and the self-contained power unit combine to aid in quick and safe turnaround operations.

(U) Aircraft reliability, as measured by Mean Time Between Failure (MTBF) was excellent. The MTBF of 1.8 hours was better than the predicted value of 1.34 and the Decision Coordinating Paper threshold of 1.78. Maintainability, as measured in maintenance man-hours per flying hour (MMH/FH), closely approximated the predicted value of 26.0 MMH/FH. Availability was also satisfactory with the flyable rate slightly below the prediction of 61 percent.

(U) Major deficiencies identified during the test were inadequate stability augmentation, unsatisfactory night lighting, and a limited use head-up display (HUD). These deficiencies have since been corrected.

(U) Phase II FOT&E, conducted by Tactical Air Command and the 354th Tactical Fighter Wing using operational squadron aircraft, began in January 1978 and terminated in June 1978. FOT&E was conducted at Myrtle Beach AFB, SC, and Savannah Airport, GA. The objectives of phase II FOT&E were to verify the data gathered during phase I as applied to an operational squadron and to document the A-10 weapon system capability when employed in squadron strength operating from both a permanent base and deployed in forward operating locations. This latter objective included the operation under normal and surge sortie rates.

(U) Aircraft availability was very good during the test, especially in view of system maturity. Reliability and maintainability were very good. Phase II test values were 21.78 maintenance manhours per flying hour and a Mean

Time Between Failure of 4.47 hours; predicted values were 21.00 and 1.78, respectively. Aircrew training requirements were completed with relative ease due to aircraft availability. Logistics supportability revealed initial spares supply level deficiencies concerning engine related items, and provisions were made to correct the situation. All operational effectiveness objectives were met. The 24 primary aircraft authorized A-10 squadron with its mobility support package showed an excellent capability to mobilize, deploy, and perform its mission under normal and sortie surge conditions from both a fixed base and deployed forward operating locations.

(U) The phase II FOT&E report, July 1979, concluded that A-10 availability, from either a main operating base or a forward operating location, was excellent. Weapon system reliability and maintainability were satisfactory during the evaluation. The deficiencies encountered in the test consisted of inadequate technical data, an unreliable aircraft boarding ladder, and the unavailability of the GAU-8 automatic loading assembly. All of these deficiencies have been corrected.

(U) The A-10 was the first aircraft to receive the Air Force's Standard Medium Accuracy Inertial Navigation System (INS). The INS FOT&E was completed in September 1981 and demonstrated accuracies within the specifications. The new INS was included in production aircraft beginning with aircraft No. 431 (November 1980). Retrofit of the INS continues and will be completed in FY 1987.

(U) The A-10 and all other fighter/attack aircraft projected for employment beyond FY 1989 will be modified with AIM-9L air-to-air missile capability for self defense. The A-10/AIM-9L Capability Evaluation was completed in August 1983 and demonstrated the A-10's ability to employ the missile and confirmed the resulting increase in survivability. Modifications are planned to begin in FY 1986 and continue through FY 1988.

(U) Engine gun gas ingestion has caused engine overtemps, and accumulation of the gas residue, over time, degrades engine performance. Ignition-on during gun firing and water-wash of the engines every 2800 rounds have temporarily solved the problems but are impractical long term solutions. After extensive developmental test a gun gas deflector device was proposed as a satisfactory solution. The A-10 Gun Gas Superkit FOT&E was completed in March 1984. Fleet retrofit began in October 1984 and will continue through October 1986.

(U) Recently published OT&E reports include:
A-10/AIM-9L Capability Evaluation, March 1984.
A-10 Gun Gas Superkit FOT&E, September 1984.

Budget Activity: 4, Tactical Programs
Program Element: 27131F, A-10 Squadrons

3. (U) System Characteristics:

Characteristic	Development Estimate	Demonstrated Performance
- Cruise Speed (KTAS)	300	342
- Forward Airstrip 1/		
Takeoff (ft)	1200	1900
Landing (ft)	1200	1460
- Loiter at 250 NM Radius (hr)		
Close Air Support(CAS) Mission	2.0 2/	1.8 3/
Antiarmor 4/	-	1.8 5/
- Bombing Accuracy, MK-82 (CEP)(mils)	15	13.6
- Strafing Accuracy (CEP)(mils)	10	4
- Sustained Load Factor 6/		
at 275 Kt (g)	3.5	3.2
at 150 Kt (g)	2.2	2.0

(U) NOTE: All values for tropic day conditions.

1/ (U) 4 MK82s, 750 rounds of 30mm ammunition and fuel for 50 NM cruise to target, 30 minute loiter, combat, 150 NM return to base, and land with fuel reserve
2/ (U) 18 MK82s, 750 rounds of 30mm ammunition, and fuel for combat and land with fuel reserve
3/ (U) 16 MK82s, 750 rounds of 30mm ammunition, and fuel for combat and land with fuel reserve
4/ (U) 6 Mavericks, 1350 rounds of 30mm ammunition, two Electronic Countermeasures Pods, full chaff/flare system, same mission profile as CAS mission
5/ (U) Estimated
6/ (U) 6 MK82s, 750 rounds of 30mm ammunition, fuel for 300 NM, land with fuel reserve

Budget Activity: 4, Tactical Programs
Program Element: 27131F, A-10 Squadrons

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Residual Development Tasks (Correction of service revealed problems)	Ongoing	Ongoing	Efforts included gun gas diverter and 30mm processing and inspection assembly (PIA) DT&E
Ground Proximity Warning System Flight Demonstration	February - May 1984	Ongoing	Schedule slip due to hardware problems

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Infrared Countermeasures Evaluation	March - April 1985	
Ground Collision Avoidance System Evaluation	February - May 1985	
Residual Development Tasks	Ongoing	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27133F
DOD Mission Area: #223 - Close Air Support and Interdiction

Title: F-16 Squadrons
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		98,637	94,628	94,859	214,114	422,410	1,952,100*
2671	F-16 A-D	94,230	76,428	76,659	210,314	418,392	1,903,475
2970	Precision Location Strike System/ Adaptive Targeting Data Link**	4,407	18,200	18,200	3,800	4,018	48,625

* Includes prior year funds for the flight demonstration of the F-16XL (Proj. #2835).
** Restructured from Precision Location Strike System/Vehicle Navigation Subsystem.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program satisfies the mission need for a lightweight, high performance, multimission fighter capable of performing a broad spectrum of tactical air warfare tasks at an affordable cost. The F-16 is designed for high sortie rates with rapid turnaround, minimum manpower and logistics burden, and exceptional air combat maneuvering performance coupled with a potent air-to-surface weapons delivery capability. The F-16 is replacing aging F-4s in the active inventory as well as modernizing the Reserve Forces.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	104,412	83,428	44,756		43,135	1,304,400
Procurement*	2,551,300	4,145,400	4,649,700		26,130,600	48,615,100
Quantity	144	150	216		1,296	2,651

* Includes weapon system and initial spares.

(U) EXPLANATION: RDT&E - the Air Force reprogrammed $5.8 million of FY 1984 funds out of the F-16 line. This action resulted from a delay in development of the Precision Location Strike System/Vehicle Navigation Subsystem (PLSS/VNS) awaiting the results of an independent review team study; also contributing was a late start in development of monopulse provisions and a slip of the Auto Terrain Avoidance (auto TA) development to an FY 1985 start. In the FY 1985

PE#: 27133F

Budget, Congress cut $12.8 million from PLSS/VNS and auto TA, but supported the development of an F-16 variant, the F-16F, for $24 million. This accounts for the net increase of $11.2 million. The FY 1986 change reflects an increase in Multinational Staged Improvement Program (MSIP) retrofit and monopulse development, the addition of the F-16F, and other minor estimating changes. The outyear changes are primarily driven by the F-16F Development.

Procurement - Congressional action reduced the FY 1985 request by $734.9 million (reduction in initial spares, long lead for 36 aircraft in FY 1986, reduction in peculiar support, cost of engines, Multiple Stores Ejection Rack (MSER) cancellation and a revised estimate for termination liability); the remaining FY 1985 difference is also due to Congressional action. FY 1986 is reduced by $956.3 million primarily due to the reduction in the FY 1986 aircraft buy by 36 and long lead for 36 aircraft in the FY 1987 buy. Updated estimates for engines and MSER cancellation also contributed to the reduction.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement: *						
Funds	2,551,725	3,306,500	3,693,400	3,661,700	30,656,600	54,891,700
Quantities **	144	150	180	180	1296	2795

* Includes weapon system and initial spares. The FY 1985/86/87 and to complete funding requirements assume follow-on F-16 multiyear procurement (MYP) program for FY 1986-89.

** The procurement estimate of 2795 F-16A/B/C/D aircraft includes F-16 procurement through FY 1993 (FYDP plus three years). However, procurement of F-16s will continue until availability of the advanced tactical fighter is assured.

5. (U) RELATED ACTIVITIES: The following program elements contain development efforts which are applicable to the F-16: PE 64314F/27163F, Advanced Medium Range Air-to-Air Missile; PE 63249F, Night Attack Program; PE 64249F, Night/Precision Attack, Low Altitude Navigation and Target Infrared System for Night (LANTIRN); PE 64725F, Aircraft Identification System (Combat Identification System); PE 64201F, Aircraft Avionics Equipment Development; PE 64218F, Engine Model Derivative Program; PE 64737F, Airborne Self-Protection Jammer; PE 27423F, Advanced Communication Systems; PE 64778F/35164F, Global Positioning System; PE 64268F, Component Improvement Program; PE 64223F, Alternate Fighter Engine; PE 64742F/27244F, Precision Location Strike Systems; PE 64739F, Tactical Protective Systems; and PE 63742F, Combat Identification Technology.

6. (U) WORK PERFORMED BY: The F-16 System Program Office of the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, has management responsibility for the F-16 program. The major contractors are General Dynamics, Fort

Worth, TX - F-16 airframe; Pratt & Whitney, East Hartford, CT and General Electric, Evendale, OH - engine; Westinghouse, Baltimore, MD - radar; and Lockheed Missile & Space Co - Adaptive Targeting Data Link (ATDL) development (Proj #2970). In addition to these, there are over 4,000 other subcontractors and suppliers in the United States. Major European manufacturers include Fabrique Nationale, Belgium - engine; SABCA/SONACA, Belgium - assembly; FOKKER, The Netherlands - center fuselage and assembly; Per Udsen, Denmark - pylons and vertical fin; Kongsberg Vapenfabrikk, Norway - inertial navigation set, fan drive module; and Marconi-Elliott, England - head-up display.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) PROJECT OVER $10 MILLION FY 1986:

(U) Project: 2671, F-16 A-D

A. (U) Project Description: This project has provided the development of the F-16 aircraft from its origin in the Lightweight Fighter prototype program in the early 1970's to the fighter aircraft currently in production and being deployed in these tactical air forces: Tactical Air Command, United States Air Forces Europe, Pacific Air Forces, and the air forces of ten other countries around the world. Continued engineering flight test is provided for the airframe, engine, aircraft subsystems and store certification; a development effort also addresses increased F-16 capability to meet the quantitative and expanding qualitative threat. Effort currently underway includes radar improvements required for use of beyond visual range (BVR) missiles and enhanced electronic countermeasures (ECM), the integration of the Advanced Medium Range Air-to-Air Missile (AMRAAM), development of an Automatic Terrain Avoidance (TA) capability to be used in conjunction with the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system, development of an F-16 combat identification (ID) capability for employment of BVR missiles, and the development of the F-16F which will incorporate changes to keep pace with the ever increasing threat and changing mission needs of the F-16 in the 1990's. Candidate changes include the cranked arrow wing design and a higher thrust engine which can provide needed payload and range increases.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The FY 1984 RDT&E funds were used for mission support, to continue support of follow-on test requirements for equipment upgrades and identified deficiencies, and to continue development of previously initiated efforts. Development of the APG-68 radar was completed and was introduced in production with the delivery of the first F-16C in Jul 1984. Integration of AMRAAM continued with production incorporation of full AMRAAM capability scheduled for Feb 1987. New efforts initiated in 1984 include the development and integration of monopulse countermeasure techniques and the development of an Operational Capability Upgrade (OCU) modification kit for block 15 F-16 A/Bs. The OCU program will add expanded memory to the imbedded computers and a data link to the APG-66 radar to allow future growth in the capabilities of these aircraft. This increase in memory is required to employ new weapons such as AMRAAM and will constitute the common aircraft configuration with our European partners. Future effort will

include development of the actual software for employment of AMRAAM on the F-16 Block 15 aircraft. Eventually, this modification will be incorporated on all block 15 aircraft. The FY 1984 production program included 144 aircraft, all of which will be F-16C/Ds.

(2) (U) FY 1985 Program: The FY 1985 RDT&E program will continue to support F-16 follow-on engineering and test requirements to correct system deficiencies, to continue weapon certification and to continue previously initiated efforts leading to weapon system enhancements. Continuing efforts include integration of the AMRAAM, development and integration of electronic warfare (EW) monopulse provisions, and development of the OCU retrofit kit for block 15 F-16 A/B aircraft. New effort planned for FY 1985 is the development and integration of Auto TA provisions including the incorporation of a digital flight control computer, development of an integrated interrogator and transponder for identification friend or foe (IFF) and pre-full scale development (FSD) effort on the F-16F. The IFF capability is required to take full advantage of beyond visual range (BVR) missile capability and currently available equipment does not fit in the F-16 airframe. The pre-FSD effort on the F-16F is designed to reduce development risk by providing an early configuration definition including structural design, flight control changes, definition of an expanded stores management set, subsystem integration, and simulation of the pilot-vehicle interface. Limited flight testing will be conducted using the F-16XL prototype primarily to investigate performance of a large engine inlet, define the need for leading edge flaps, continue investigation of flight control enhancements and other potential configuration changes requiring flight test verification. This effort anticipates an FSD start in FY 1987 with first production of an F-16F in the FY 1989 buy.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 RDT&E will continue to fund the follow-on engineering and test support and mission support for the F-16 System Program Office (SPO). This effort includes laboratory support, Air Force Operational Test and Evaluation Center (AFOTEC) support, computer support, Seek Eagle stores certification, etc. In addition, several efforts initiated in prior years will be completed and incorporated into production F-16s. These include: Advanced Medium Range Air-to-Air Missile (AMRAAM) integration, electronic warfare (EW) monopulse provisions, Auto Terrain Avoidance (TA) with a digital flight control computer, and an integrated interrogator and transponder IFF system. These system enhancements will provide the F-16 an adverse weather, BVR missile capability with the IFF equipment to fully utilize the capability provided by the AMRAAM. The electronic warfare improvements will give the F-16 increased capability in the ever increasing EW environment and the Auto TA capability will facilitate low altitude, night, under the weather operation using the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system. The F-16F pre-FSD efforts initiated in FY 1985 will be continued, leading to the initiation of the FSD effort in FY 1987. The development of the Operational Capabilities Upgrade (OCU) retrofit kit for Block 15 F-16 A/Bs will also be continued and will include the development of AMRAAM software. Cost estimates are categorized as comprehensive (category I) and are based on annual "Grass Roots" program office estimating procedures.

(4) (U) Program to Completion: This is a continuing program and will continue to fund follow-on test and engineering, as well as program office mission support. The FY 1987-90 RDT&E effort will be dominated by the

development of the F-16F which will continue through FY 1990. Initial production of an F-16F is planned for the FY 1989 procurement with first delivery of this model in late 1990. The development of the OCU retrofit kit for block 15 F-16 A/Bs will be completed and the retrofit program for the F-16 A/B aircraft will begin in late 1987.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Source Selection/Award Development Contract	January 1975
(2) (U) Defense Systems Acquisition Review Council (DSARC) II	March 1975
(3) (U) European Long Lead Funds Released	June 1976
(4) (U) Delivery First Full Scale Development Aircraft	December 1976
(5) (U) DSARC IIIA (Long Lead Release)	January 1977
(6) (U) DSARC IIIB (Production)	October 1977
(7) (U) First Aircraft to Tactical Air Command	January 1979
(8) (U) First European Aircraft	January 1979
(9) (U) Initial Operational Capability (IOC)	October 1980
(10) (U) Delivery of 651st Aircraft	September 1983
(11) (U) Initial Delivery of the F-16C	July 1984
(12) (U) F-16F FSD Go-ahead	October 1986
(13) (U) Delivery of First F-16F	1st Quarter 1991
(14) (U) Delivery of Last F-16 (2795)	May 1995*

* Has been extended one year with the addition of 216 aircraft in FY 1993.

9. (U) PROJECT OVER $10 MILLION IN 1986:

(U) Project: 2970, Precision Location Strike System/Adaptive Targeting Data Link (PLSS/ATDL)

A. Project Description: Tactical Air Force Required Operational Capability (TAF ROC) 314-74 (validated) stated the need for a defense suppression capability with [ ] The F-16 ATDL capability is a strike asset associated with PLSS which satisfies this requirement.

The PLSS/ATDL provides the interface between the PLSS and the tactical aircraft. PLSS, through the ATDL, will provide the F-16 pilot with precise target location, waypoints for guidance to the target, and information on enemy defenses both enroute and in the target area. [ ]

(U) This project was previously called the Precision Location Strike System /Vehicle Navigation Subsystem (PLSS/VNS). The program name has changed to reflect the deletion of the Distance Measuring Equipment (DME) navigation from the capability as recommended by the Independent Review Team. Instead, the DME data link is now used to pass targets and update data between the PLSS ground station and the PLSS/ATDL-equipped F-16 aircraft. This concept relies on the Global Positioning System for precise navigation of the aircraft to the target and, thus, deletes duplicative navigational functions.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Contractor efforts were stopped between December 1982 and April 1984 as a result of the transfer of the Precision Location Strike System/Vehicle Navigation Subsystem (PLSS/VNS) development to the F-16 line. Contractor efforts resumed in April 1984 and included rebuilding technical teams and identifying required technical changes to the VNS preliminary design. The FY 1984 effort continued design of Group A and B equipment. This included the antenna, distance measuring equipment, and PLSS interface unit.

(2) (U) FY 1985 Program: Now redesignated the PLSS Adaptive Targeting Data Link (ATDL), a detailed design will be completed and documented at a Preliminary Design Review in June 1985. The PLSS Central Processing Subsystem ATDL software development will begin, as well as ATDL fabrication.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: ATDL detailed design will be completed and a critical Design Review will be accomplished by January 1986. Fabrication, test equipment development, system integration and testing will continue.

(4) Program to Completion: System reviews will occur including the Functional Configuration Audit, Physical Configuration Audit, and Production Readiness Review. Long lead production will be initiated. System integration and testing including contractor tests, and combined Development Test and Evaluation/Initial Operation Test and Evaluation (DT&E/IOT&E) will be completed. PLSS Group B production will begin. PLSS Group A will be incorporated [ ]

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Tactical Air Force Required Operational Capability (TAF ROC) 314-74 (Location Strike System)	October 1974
(2)	(U)	PLSS Defense Systems Acquisition Review Council (DSARC) II	July 1977
(3)	(U)	Vehicle Navigation Subsystem (VNS) Preliminary Design Review	December 1982
(4)	(U)	Stop Work In PLSS Line	February 1983
(5)	(U)	Restart Contractor Effort In F-16 Line	April 1984
(6)	(U)	VNS restructured and redesignated ATDL	January 1985
(7)	(U)	ATDL Preliminary Design Review	June 1985
(8)	(U)	ATDL Critical Design Review	January 1986
(9)	(U)	Production start	FY 1989

Budget Activity: 4, Tactical Programs
Program Element: 27133F, F-16 Squadrons

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): General Dynamics is the prime contractor for airframe and support equipment development and Pratt & Whitney is responsible for continued development of the F100 engine. The General Electric F110 engine will be introduced in production in 1986. Most of the major development testing on the basic aircraft, subsystems, and support equipment have been completed. Performance and stability and control testing indicate that the aircraft can meet design specifications and be employed effectively throughout the flight envelope. The F-16 has demonstrated that it can carry and employ a varied mix of weapons including air-to-air ordnance, air-to-surface guided missiles, conventional bombs, and nuclear weapons. The F-16 radar meets basic specifications and can be used effectively to deliver air-to-air and air-to-ground weapons. Ground testing results indicate an airframe life of at least 8,000 hours. As would be expected in any development program, there have been changes required to correct problems identified during the test program. Fixes have been designed, tested, and incorporated into the production aircraft. The last of the development aircraft was delivered in August 1978 and the first F-16 unit was activated at Hill Air Force Base, UT, in January 1979. All weather testing in desert and tropical climates is completed. Alaskan cold weather tests and an evaluation in European weather conditions were completed in early 1979. Testing to evaluate engine inlet icing problems was initiated in Calendar Year 1979 and verified the value of the heated inlet strut and engine anti-ice improvements.

(U) Future flight tests will include certification of additional weapons, continued systems integration tests, and evaluation of fixes for previously identified deficiencies. The major test activity in follow-on development will be evaluation of the enhancement of aircraft systems necessitated by threat evolution. Reliability and Maintainability (R&M) testing has been an integral part of the development effort and the F-16 currently indicates it can meet R&M goals established at program approval.

(U) There were originally eight full scale development aircraft and a decision was made in 1980 to authorize 11 production aircraft to upgrade the F-16 test fleet. Of the original eight aircraft, two have been decommissioned, one has been leased to General Dynamics for the F-16/J79 program, one is assigned to the Advanced Fighter Technology Integration program, two have been modified under the General Dynamics Independent Research and Development program to the F-16XL configuration, and two are still being used at the Air Force Flight Test Center for follow-on testing.

(U) The two F-16XL aircraft are at Edwards AFB for the flight evaluation of this configuration. Of the 11 production aircraft, six are assigned to Eglin AFB (Advanced Medium Range Air-to-Air Missile (AMRAAM), SEEK EAGLE, and weapons development) and four are assigned to Edwards AFB (follow-on testing, and Multinational Staged Improvement Program (MSIP) avionics integration including the new radar). One production aircraft was attrited in a Class A accident. This test force will be augmented with up to eight operational aircraft which will be used to support Low Altitude Navigation and Targeting Infrared for Night (LANTIRN), Global Positioning System (GPS), Advanced Self Protection Jammer (ASPJ) and ALR-74 DT&E and IOT&E efforts.

Budget Activity: 4, Tactical Programs
Program Element: 27133F, F-16 Squadrons

(U) Over the next year the major test efforts will be in support of the APG-68 and integration of the other Multi-staged Improvement Program (MSIP) avionics in addition to the normal follow-on testing and weapons certification. Testing in support of the growth systems being added to the F-16 (AMRAAM, LANTIRN, ASPJ, GPS, etc.) will continue to grow as these near their production effectivity.

2. (U) Operational Test and Evaluation (OT&E): The F-16A/B initial operational test and evaluation (IOT&E) was conducted in conjunction with development test and evaluation (DT&E) from December 1976 to October 1977. The IOT&E results reported in the Air Combat Fighter IOT&E Final Report, January 1978, US Government distribution, supported a production recommendation to the Defense Systems Acquisition Review Council (DSARC) IIIB. Follow-on test and evaluation (FOT&E), Phase I, was completed in January 1979 and reported in the F-16 (A/B) FOT&E Final Report, Phase I, June 1979, US Government distribution.

(U) The purpose of the OT&E was to evaluate the operational suitability and effectiveness of the F-16A/B weapon system. The radar/head-up display/fire-control system interface was evaluated in air-to-air missions against projected simulated threat aircraft and in air-to-surface attack missions. Air-to-air weapons such as the AIM-9 and M61 gun were fired at realistic maneuvering targets. Day and night evaluation of the F-16A/B air refueling capability was accomplished. The F-16A/B's performance and handling characteristics were qualitatively and quantitatively evaluated while performing basic fighter maneuvers (BFM) and air combat maneuvers (ACM) against current and projected simulated threat aircraft. The electronic countermeasures (ECM) capability and electromagnetic interference (EMI) susceptibility of the F-16A/B were evaluated. In addition, the operational suitability evaluation included: reliability and maintainability to include maintenance support factors, potential maintenance safety hazards, and determination of training requirements and operating and support costs.

(U) This F-16A/B combined DT&E/IOT&E was conducted primarily at Edwards AFB, California. Other test sites were Nellis AFB, Nevada; China Lake NWC, California; Alaska; El Centro NAF, California; Yuma Marine Corps Air Station (MCAS), Arizona; Panama, CZ; and Eglin AFB, Florida. An Air Force Operational Test and Evaluation Center (AFOTEC) test team composed of personnel from AFOTEC, Tactical Air Command (TAC), Air Force Logistics Command (AFLC), and Air Training Command (ATC) conducted the OT&E portion of the combined tests. Additionally, a combined Air Force Systems Command (AFSC)/AFOTEC European test and evaluation (ET&E) with three aircraft was conducted from February to May 1979. Test sites included Bodo AB, Norway; Skrydstrup AB, Denmark; Hahn AB, Germany; and Alconbury AB, United Kingdom. Test resources were incrementally increased to a total of 11 aircraft of which 8 were preproduction aircraft and 3 were production.

(U) FOT&E Phase II was conducted at Hill AFB, Utah, and in Europe from January 1979 through December 1980. TAC was responsible for operational effectiveness, and AFOTEC further evaluated operational suitability. The AFOTEC assessment included reliability and maintainability data generated by all F-16A/B aircraft assigned to Hill AFB, Utah.

(U) F-16A/B FOT&E/tactics development and evaluation (TD&E) Phase II, designated MOT&E, commenced during January

Budget Activity: 4, Tactical Programs
Program Element: 27133F, F-16 Squadrons

1979 at Hill AFB, Utah. This FOT&E/TD&E was conducted jointly by the Air Forces of Belgium, Denmark, the Netherlands, Norway, and the United States. MOT&E consisted of two parts: Part I, completed in the United States (Hill AFB) from January 1979 through June 1980, used test facilities and ranges at the following locations: Dugway/Wendover, Utah; White Sands Missile Range, New Mexico; and the Nellis Range complex in Nevada. Part II was conducted in Europe from locations within the countries of the European Participating Air Forces (EPAF) between July and December 1980. In both parts of the MOT&E program, a mix of USAF and EPAF production aircraft was used, with a maximum of 10 F-16A/Bs used as test assets during Part II and 7 F-16s during Part II. TAC was responsible for the operational effectiveness and tactics development objectives; AFOTEC was responsible for the suitability assessment.

(U) The purpose of the MOT&E was to refine estimates of F-16A/B operational effectiveness, assist in evaluation of configuration changes, develop tactics and operating concepts for F-16A/B employment, and assess the operational suitability of the aircraft. The TAC F-16 MOT&E Final Report and Tactics Manual were released in May 1981.

(U) AFOTEC flew 467 front seat and 98 back seat sorties during IOT&E/FOT&E. This included six months of testing on two near production-configured full scale development aircraft and seven aircraft-months on the first three production aircraft. OT&E included beyond-visual-range missions with F-4 and T-38 aircraft; operational comparisons, Basic Flight Maneuvering (BFM), and Air Combat Maneuvering (ACM) with F-4E, F-5, A-37, and T-38 aircraft; night and day air-to-surface bombing and strafe; air-to-air gunnery against towed targets; and AIM-9M/L firings against BQM-34, PQM-102, and QH-50 drones. Overall weapons system performance and reliability and maintainability estimates were rated satisfactory.

(U) During the ET&E, the F-16A/B was used in a wide variety of realistic operational mission scenarios to provide an assessment of its effectiveness and suitability when operated in its intended environment. One hundred forty-two sorties were flown for an effective sortie rate of 0.78 which was well above the planned rate of 0.50. As reported in the European Test and Evaluation Final Report Addendum F-16 FOT&E Phase I, November 1976, US Government distribution, overall F-16A/B performance was highly satisfactory. Taxi, takeoff, and landing on icy surfaces presented no major problems. F-16A/B reliability and maintainability during ET&E was satisfactory to excellent.

(U) F-16A/B operational suitability, as reported in the F-16 Operational Suitability Test and Evaluation, Phase II Final Report, October 1980 (US and EPAF distribution), was overall satisfactory during Part I MOT&E; however, adequacy of funding levels for war readiness spares kits (WRSK), F100 engine support, and weapon system spare parts will continue to be critical to F-16A/B supportability in the outyears. MOT&E Part II (Europe) suitability results were highly satisfactory. With the exception of potential long-term impacts from aircraft corrosion caused by industrial pollution, F-16A/B operations in Europe did not produce significantly different conclusions from those drawn during Part I MOT&E.

(U) The Air Force Operational Test and Evaluation Center (AFOTEC) participated in a combined DT&E/Operational Utility Evaluation (OUE) of the F-16 Dual Role Fighter (DRF) from July 1982 through April 1983 at Edwards AFB, California. The F-16 DRF is a significantly modified F-16 featuring a cranked arrow wing and slightly stretched fuselage. The modifications provide more avionics space, more f[illegible] capacity, and semi-conformal carriage of weapons. The purpose of AFOTEC's OUE was to provide performance data fo[illegible]parison with the F-16A/B to support a derivative

fighter full-scale development decision. The effectiveness evaluation concentrated on aerodynamic handling qualities, range/payload capabilities, and weapons delivery. AFOTEC testing emphasized air-to-surface mission capabilities. Effectiveness data were collected on 36 dedicated OUE sorties. Suitability data were collected on approximately 326 combined DT&E/OUE sorties.

(U) The F-16 DRF demonstrated an improved air-to-surface operational capability while retaining its basic air-to-air capability. The prototype F-16 DRF demonstrated improvements over the F-16A in maximum air-to-surface combat radius, performance, and handling qualities. It also exhibited an improved capability in theater air defense radius and loiter time. The F-16 DRF was similar to the F-16A in tactical ferry range, routine operations, and operational suitability. However, the F-16 DRF performance was inferior to the F-16A in 1 versus 1 within-visual-range air combat maneuvering.

(U) The Air Force Operational Test and Evaluation Center (AFOTEC) is participating in a combined DT&E/IOT&E of the F-16 Multinational Staged Improvement Program (MSIP) from January 1983 through December 1988. The MSIP consists of phased improvement in F-16 air-to-air and air-to-surface capabilities by changes in avionics and subsystems. Basic changes include an improved radar (APG-68), wide-angle conventional HUD, improved cockpit displays, General Electric F110 engine, an enhanced fire control computer, and interfaces for follow-on subsystems such as: AMRAAM, LANTIRN, GPS, ASPJ, HAVE QUICK, PLSS, AGM-65D, and ALR-74. AFOTEC's evaluation will concentrate on the effect of MSIP changes on overall F-16 performance; the integration of subsystems, hardware, and software single-seat operability in all required missions and environments; pilot interface with controls and displays, combat sortie generation capability; and weapon system reliability.

(U) Published OT&E reports include:

(1) F-16 A/B IOT&E Final Report, January 1978.
(2) F-16 A/B FOT&E Final Report, June 1979.
(3) F-16 A/B MOT&E Final Report and Tactics Manual, May 1981.
(4) F-16 DRF OUE Final Report, November 1983.

3. (U) Systems Characteristics:
(U) Technical Information:

(U) Length (ft)	49.5
(U) Wing Span (w/missiles) (ft)	32.8
(U) Operating Weight (empty) (lbs)	16,126 1/
(U) Internal Fuel (lbs)	6,972
(U) Current Max Takeoff Gross Weight (lbs)	37,500
(U) Max Payload w/Full Internal Fuel (lbs)	12,302
(U) Engine Thrust (lbs)	23,759

1/ Projected Block II weight (aircraft #160).

Budget Activity: 4, Tactical Programs
Program Element: 27133F, F-16 Squadron

(U) Performance Thresholds: (F-16 Deve.opment Concept Paper)

	Threshold	Demonstrated
Radius - Air Superiority Mission (NM)		
Radius - Air-to-Surface Mission (NM) 1/		
Sustained Turn Rates		
1.2 Mach/30,000 ft (°/sec)		
1.2 Mach/30,000 ft (G)		
0.9 Mach/30,000 ft (°/sec)		
0.9 Mach/30,000 ft (G)		
Acceleration Time		
0.9-1.6 Mach/30,000 ft (sec)		
Max Controllable G		
0.8 Mach/40,000 ft (G)		
(U) Ferry Range (NM)	2200	2168

(U) Other Characteristics:

	Threshold	Demonstrated
(U) Takeoff Distance (Air-to-Air Mission) (ft)	N/A	2200
(U) Landing Distance (ft) (estimated)	N/A	3300
(U) Mission Reliability (%)	90	91
(U) Mean Flight Time Between Failure (hrs)	2.90	3.05
(U) Radar Detection Range, 2 sq meter Target (look up/look down) (Current APG-66)	24/18	24/18

4. (U) Current Test and Evaluation (T&E):

Event	Planned Activity	T&E Activity (Past 12 Months) Actual Date	Remarks
F-16A/B Improvements	Continuing	Dec 76 to present	Continued testing for weapons certification and F-16A/B model improvements/correction of deficiencies for both airframe and engine hardware; ongoing at Edwards AFB and Eglin AFB.
F-16C/D (MSIP) DT&E	Continuing	Nov 82 to present	Structural and avionics testing related to MSIP Stages I and II; Alternate Fighter Engine (AFE) development ongoing at Edwards AFB.
F-16C/D MSIP Stage II Combined DT&E/IOT&E	Dec 82 to Mar 85	Jan 83 to present	Very little effective operational testing has been accomplished due to the late arrival of the test aircraft, APG-68 improved radar, MSIP Stage II hardware, and associated software.

Budget Activity: 4, Tactical Program
Program Element: 27133F, F-16 Squadron

Event	Planned Date	T&E Activity (Next 12 Months) Actual Date	Remarks
F-16A/B Improvements	Continuing		Continued F-16 testing related to system enhancements is scheduled.
F-16C/D (MSIP)	Continuing		Completion of MSIP II development testing on presently available MSIP II systems; transition into MSIP III integration testing.
F-16C/D MSIP Stage II IOT&E	Jan 85 to Mar 85	TBD	Constant slips in hardware and software have reduced the amount of time and events available prior to production aircraft deliveries to TAC begun in December 1984. TAC baseline is Block 25B. F-16C/D MSIP Stage III IOT&E will begin after Stage II is complete.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27136F
DOD Mission Area: #224 - Defense Suppression

Title: F-4G Wild Weasel Squadrons
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		37,070	55,267	36,707	12,600	TBD	TBD
327B	F-4G Wild Weasel Squadrons	37,070	55,267	36,707	12,600	TBD	TBD

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The F-4G Wild Weasel is the only operational destructive defense suppression weapon system in the Air Force inventory. This system is specifically designed to automatically detect, identify, locate, and destroy hostile radars. F-4G armaments consist of anti-radiation missiles, standoff guided munitions, and conventional F-4 weapons. The F-4G is classically employed in the counter-air role as an escort for the penetration strike force, as an independent hunter-killer force, or as a standoff defense suppression force. The present R&D effort is to update the capabilities of the F-4G so that it can contend with the exotic threat radars being deployed now and through the 1990's. The original requirement for an advanced Wild Weasel aircraft was validated in FY 1968. The F-4G was developed and produced in response to this requirement. Initial Operational Capability (IOC) was achieved on 1 April 1979. As the threat complexity and density increased, the need to keep the Wild Weasel current with the new threats was evident. The Performance Update Program (PUP) for the F-4G Wild Weasel responds to this requirement.

(U) Some FY 1985 funding ($8.0 Million) is for an F-4 Modernization Demonstration project to demonstrate the concept of modifying an F-4 with new engines, conformal fuel tanks, and new avionics to provide an option for foreign governments to upgrade their F-4s.

Program Element: #27136F
DOD Mission Area: #224 - Defense Suppression

Title: F-4G Wild Weasel Squadrons
Budget Activity: #4 - Tactical Programs

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	37,620	55,267	40,505		Continuing	N/A
Aircraft Procurement	25,100	18,300	29,800		320,500	393,700

Required FY 1986 Procurement funding will come from the F-4E to F-4G Conversion program. These conversion aircraft will be the first to receive the Performance Update Program (PUP) Phase II and funding has been identified within this program in FY 1984 and FY 1985 to buy PUP kits for the modification. The E to G funding will be used in FY 1986 to start PUP Phase II procurement. Change in total procurement cost based on revised estimate and a change in procurement strategy. Original estimate assumed that the Air Force would take over system integration responsibilities from the prime contractor at production decision and buy all components directly from the subcontractors. Position now is that the Air Force does not have the engineering manpower or expertise to handle system integration and the prime contractor will keep overall responsibility through production and initial fielding.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total
Aircraft Procurement:						
Funds (3010/1100)	25,100	18,300	0	212,000	215,000	470,400
Quantities	52	54	0	55	65	226

Aircraft procurement shown is for PUP Phase I in FY 1984 and FY 1985 and PUP Phase II in FY 1987 and beyond. Additional aircraft procurement funds for other F-4 modifications are not shown.

5. (U) RELATED ACTIVITIES: Air Force advanced and engineering development program elements (PE 63718F - Electronic Warfare Technology, PE 64738F - Protective Systems, PE 64739F - Tactical Protective Systems) developed the generic electronic combat technologies necessary to counter the advanced threat radars. The Imaging Infrared (IIR) Maverick - PE 27313F, and the High Speed Anti-Radiation Missile (HARM) - PE 27162F are both programmed for interface with the F-4G. A new inertial navigation system (ARN-101) is to be installed by Air Force Logistics Command as a Class IV modification and will interface with the APR-38 Attack/Warning Receiver on the F-4G. The above programs are responsible for developing and funding the required interfaces for the F-4G/APR-38 system; however, this program element will ensure overall system capability/integration. Modification of the F-4G with performance updates developed in this program will begin in FY 1986.

6. (U) WORK PERFORMED BY: McDonnell Douglas, St Louis, MO, is the primary contractor for the F-4G Wild Weasel Performance Update Program. Subcontractors for the PUP are Sperry Univac, Minneapolis, MN, E-Systems, Garland, TX, and Micro Phase, Long Island, NY. Texas Instruments, Dallas, TX, builds the Memory Loader Verifier (MLV) to upload and download the software into the APR-38. Singer-Link, Binghamton, NY, built, and now updates the F-4G simulator. Ogden Air Logistics Center, UT, is responsible for the management of F-4G enhancement programs. Air Force Systems Command (AFSC), Andrew AFB, MD; Air Force Operational Test and Evaluation Center, Kirtland AFB, NM, and Tactical Air Command, Langley AFB, VA, are jointly responsible for testing of the F-4G. AFSC is responsible for the subsystem and interface development of F-4G/APR-38 enhancements.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 327B, F-4G Wild Weasel Squadrons

A. Project Description: The AFR-38 radar warning and attack system is the backbone of the F-4G Wild Weasel. Its current design is to counter the mid-1970's threat. For the F-4G to be effective, the Air Force must update the APR-38 performance to more rapidly process enemy threat systems and cover a larger portion of the electromagnetic spectrum. The Performance Update Program (PUP) for the APR-38 will enable the F-4G to handle the 1990's threat by increasing the capacity of the onboard computer, increasing frequency range, and increasing system processing speed to enable it to handle the increasingly complex radar signals and denser signal environment. The update will also enable the F-4G to fully exploit the capabilities of the High Speed Anti-Radiation Missile (HARM). Proposed future updates to the APR-38 will include detection identification, and location of [ ] and other advanced threats. All updates will also be incorporated into the F-4G simulator.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Phase I of the PUP, expansion of the computer from 64K to 256K storage words capacity began October 1982. Phase II, frequency extension, capability against agile and low probability of intercept radars, capability against ground based jammers, and dense environment processing capability, began in March 1983. Phase I efforts accomplished in FY 1984 were building the first six preproduction models of the new computer, finishing the translation of the existing computer software program to the AF standard language (Military-Standard-1750A) and the HARM software program for the new computer, and finalizing improved ambiguity resolution and builtin test routines. Phase II efforts in FY 1984 continued the engineering development of a new channelized receiver/processor and start of fabrication of the prototype system components.

(2) FY 1985 Program: R&D for Phase I of the PUP will be completed in early FY 1985. The new Phase I computer will undergo Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E). Phase II will continue work on the receiver/processor, develop new antenna arrays to increase frequency coverage to [ ] improve

azimuth and ranging accuracy, develop new software support equipment, and modify existing hardware support equipment. The initial go-ahead to proceed with production on Phase I will be given in January 1985 with the final production decision scheduled for June 1985. A task which is not associated with the PUP, the simulator modification for the ARN-101 inertial navigation system which was started in FY 1984, will be continued.

(U) A separate effort from the PUP, funded in FY 1985, is an F-4 Modernization Demonstration to evaluate the effectiveness and potential foreign military sales benefits of putting new engines, new avionics, and conformal fuel tanks on existing F-4s. This demonstration will help determine the cost effectiveness and capability increase which could be realized by such an extensive modification. The cost of this demonstration is estimated to be approximately $8.0 million in FY 1985. This cost estimate is considered Category IV.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The new computer developed in Phase I will complete testing and begin to be installed on the aircraft. Phase II efforts will continue on the receiver/processor new antenna arrays to increase frequency coverage, and support equipment modification. Specific tasks include completion of Operational Test and Evaluation (OT&E) of the Phase I computer at George Air Force Base, CA; modification of the Electronic Environment Simulator (EES); and start of aircraft installation of Phase I. Phase II related tasks include: prototype Directional Receiver Group (DRG) airworthiness qualification and reliability testing; low frequency synthesizer prototype delivery and airworthiness qualification and reliability testing; software program finalization for Phase II flight testing; and start of Phase II flight tests. The initial go-ahead to proceed with Phase II production is scheduled for July 1986. Modifications to incorporated the Performance Update Program (PUP) into the F-4G simulators will continue and a contract to build the depot support equipment for the PUP will be awarded. The RDT&E cost estimate is considered mature or Category II; the latest comprehensive update to these figures was in November 1984. The cost estimate for Phase I production is mature or Category II. Phase II production estimates are considered as planning estimates or Category IV. Both Phase I and Phase II production estimates were updated in November 1984. Production estimates are based on a sole source buy from the prime RDT&E contractor.

(4) (U) Program to Completion: The new computers in Phase I will be procured and installed through 1987. Initial Operational Capability (IOC) for Phase I is FY 1986. Phase II will continue full scale development through FY 1987. Procurement of the receiver/processor and other components in Phase II begins in FY 1987, with an IOC in FY 1988. Full Operational Capability (FOC) for Phase II will terminate the current PUP effort. However, this is a continuing program. Future R&D efforts and/or modification programs for the F-4G will be funded through this Program Element as required.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Performance Update Program Contract Award	October 1982
(2)	(U)	Phase I Efforts Initiated	October 1982
(3)	(U)	Phase II Efforts Initiated	March 1983
(4)	(U)	Phase I Production Decision *(January 1985)	June 1985
(5)	(U)	Phase II Flight Test Start	July 1986
(6)	(U)	Phase I IOC	September 1986
(7)	(U)	Phase II IOC	September 1988

*Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(4) (U) Phase I Production Decision slipped five months due to initial problems producing gate arrays (high speed chips) in sufficient quantities to support preproduction unit development. Phase I IOC can still be met.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27162F
DoD Mission Area: #224 - Defense Suppression

Title: Tactical Air-to-Ground Missiles
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,965	2,000	3,926	3,924	2,452	42,730
2330	HARM	1,649	2,000	3,926	3,924	2,452	41,414
2331	Sidearm	1,316	0	0	0	0	1,316

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The increased sophistication, concentration, and lethality of enemy ground-based, radar guided, missile and antiaircraft artillery systems threaten the ability of tactical aviation to accomplish its mission and survive. Antiradiation missiles provide a destructive counter to this threat. The High Speed Anti-Radiation Missile (AGM-88, HARM) has been developed by the Navy to provide a significantly upgraded capability against the threat. However, while the current HARM performance characteristics were defined during the DSARC II A in February 1978, the threat has changed during the ensuing development period. The F-4G Wild Weasel represents the only dedicated destructive defense suppression weapon system in the Air Force inventory. When deployed, HARM will be its primary weapon. When fully available in all theaters, HARM will be the F-4G's primary weapon and will remain so through the late 1990's.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,065	3,695	0		0	35,923
Procurement (Missile)*	175,764	326,284	523,895		1,756,367	2,941,000
Quantities	341	871	1682		6264	9405

* Excludes spares

(U) The FY 1984 RDT&E difference reflects Air Force discontinuing the Sidearm program and reprogramming $1.1 million to higher priority programs. The RDT&E difference in FY 1985 reflects a $1.695 million Congressional reduction. The FY 1986 and total estimated cost differences reflect the additions for the Air Force share of a joint, near term product improvement program to correct identified system deficiencies against the current threat baseline.

(U) The FY 1985 Procurement difference reflects a $31 million Congressional reduction due to new estimates of a lower High Speed Antiradiation Missile (HARM) unit price. The new lower unit price estimates are reflected in the FY 1986 column by increased quantity procured to lessen the existing shortfall of HARM. The Procurement Total Estimated Cost difference of -$356.7 million reflects the lower cost estimate to procure 9167 HARM.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
HARM						
Procurement (Missile)*	175,764	295,300	478,107	618,588	850,942	2,585,301
Quantities	317	871	1715	2529	3494	9167

*Excludes initial spares

5. (U) RELATED ACTIVITIES: The HARM has been designated as the primary Anti-Radiation Missile for the F-4G Wild Weasel. A Memorandum of Agreement of July 1975 between the Air Force and Navy Assistant Secretaries for Research and Development names the Navy as the Executive Service and the Air Force as the Participating Service in the Joint Service HARM Development Program. The F-4G APR-38 Radar Homing and Warning Receiver is optimized in Program Element 27136F, F-4G Wild Weasel Squadrons, to fully use HARM's capabilities. Navy resources for Lower Cost Seeker (LCS) development are in Program Element 63301N, Electrical Radiation Source Elimination (ERASE) and Air Force resources are covered in PE 64302F, Defense Suppression Weapons Engineering Development.

6. (U) WORK PERFORMED BY: The HARM Development Program is managed by the Navy HARM Program Office, at Naval Air Systems Command, Arlington, VA, with an Air Force Deputy Program Manager and staff. Management of Air Force unique requirements is provided by the Armament Division, Eglin AFB, FL. Principal contractors are: Texas Instruments, Lewisville, TX; McDonnell Douglas Aircraft Corporation, St Louis, MO; Thiokol, Brigham City, UT; and Motorola, Scottsdale, AZ. Government facilities such as the Aeronautical Systems Division, Wright-Patterson, AFB, OH; Naval Weapons Center, China Lake, CA; and the Air Force Flight Test Center, Edwards AFB, CA are also utilized. Air Force independent testing is conducted by dedicated personnel from the Air Force Operational Test and Evaluation Center (AFOTEC), Kirtland AFB, NM; and by operational Tactical Air Command pilots detailed to an AFOTEC test detachment.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2330, HARM:

A. Project Description: This project includes a new product update program to improve the HARM performance against the current threats in the near term. The F-4G/HARM will be the lethal defense suppression weapon system in

the field for a considerable time into the future. It is imperative that a fully effective system be fielded with the F-4G during the 1980's and beyond. The Air Force, as participating service, will share in funding this near-term update with the Navy, which will provide improved High Speed Anti-Radiation Missile (HARM) performance against the newer agile, high density signal threats. The requirement for an advanced HARM was identified by the Tactical Air Forces in March 1975. The Air Force identified the AGM-88 HARM as the solution for the near term portion of this requirement. Missile design goals are: moderate missile size and weight, short time to target[ ]from level launch at 10,000 feet, 0.8 Mach to target at 10 nautical miles); high accuracy[ ]median Closest Point of Approach); high sensitivity wideband frequency coverage in a single seeker[ ]Gigahertz); long standoff range (up to[ ]nautical miles); and the ability to change to different target frequencies should the initial target radar shutdown while the missile is in flight. The HARM, integrated with the F-4 Wild Weasel, gives the Tactical Air Force a dedicated and highly capable antiradiation weapon system. HARM is most capable against the[ ] The enemy has began to rely on a more complex and dense signal environment which the HARM improvement program will address in the near term update. The Air Force, as participating service, will share in funding this near-term update to HARM with the Navy. RDT&E cost estimate is based on program office engineering cost projections and contractor quotes. The program cost estimate is Type IV, current as of August, 1984.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Correction of deficiencies found during test and evaluation continued. This effort included fuzing enhancement to improve system lethality, software optimization to enhance operational effectiveness, and reliability improvements to improve missile availability. Additionally, first order studies on integration possibilities on other (non-F-4G) tactical fighters were initiated. Air Force Initial Operational Capability was obtained. Air Force procured 317 missiles in FY 1984, and has options to procure up to 341 missiles.

(2) FY 1985 Program: A Product Improvement Program will be initiated to optimize the effectiveness of HARM against the current threat. This program focuses on the missile computer processing capability and software to improve effectiveness in the expected dense signal environment, as well as to handle the newer, more complex signals[ ] The Air Force plans to procure 871 missiles in FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The Air Force will continue the Product Improvement Program and will complete laboratory testing and initial flight testing of the improvements. Air Force plans to procure 1775 missiles in FY 1986.

(4) (U) Program to Completion: The Product Improvement Program continues with final testing, production incorporation, and possible retrofit initiation in early FY 1988.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

Budget Activity: 4, Tactical Programs
Program Element: 27162F, Tactical Air-to-Ground Missiles (AGM-88)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The AGM-88 High Speed Antiradiation Missile (HARM) is a joint Navy/Air Force project with the Navy as Executive Service. The Navy conducted Engineering Development under Program Element 64360N. Naval Weapons Center, China Lake was the lead organization. Texas Instruments was chosen as the Weapon System Integration Contractor. The Air Force Development Test and Evaluation addressed the integration of the HARM with the F-4G Wild Weasel, which contains the APR-38 avionics suite. Since 1977, modifications to the F-4G to integrate the HARM have been developed, bench tested, and have flown in a series of captive flight missions. Computer software developed to integrate the HARM with the APR-38 has been bench/ground tested and evaluated in captive flight tests and HARM firings from the F-4G.

(U) Prototype missiles and pilot production missiles were procured during DT&E. Prototype and pilot production hardware contain extended HARM frequency coverage and improved maneuverability capabilities which were developed during the extended phase of advanced development. Test results are shown in Navy Program Element 64360N Descriptive Summary.

Prototype Missiles - These missiles were tested to evaluate performance of the contractor prototype design against a variety of target signatures in five operational scenarios. The prototype hardware was subjected to ground tests, captive flight tests and firing tests. Objectives included acquisition and tracking of characteristic target signatures in various operational scenarios, compatibility with the full electromagnetic environment, and verification of hazard free performance to aircraft and handling personnel. An indication of operational effectiveness and suitability was obtained. The modified F-4G/APR-38 avionics capability to control and monitor the High Speed Antiradiation Missile (HARM) was demonstrated. [ ] development test firings were completed, resulting in [ ] The average miss distance was [ ] (as compared to the required [ ] circular error probable). Although these were development tests, they were fired by operational test pilots from both services. A Department of the Navy Systems Acquisition Review Council II B held in Nov 1980 evaluated test results of prototype missile firings, and approved proceeding to pilot production in 1981.

(U) Pilot Production Missiles - Forty-five pilot production missiles were allocated for both completion of Development Test in the Navy Technical Evaluation, and for the joint Air Force Initial Operational Test and Evaluation, (IOT&E) and Navy Operational Evaluation. Five of the forty-five pilot production missiles were fired by the Navy to complete Navy Technical Evaluation. The joint operational testing commenced in Nov 1981, and the balance of the forty pilot production missiles were allocated between the Navy and the Air Force. Twenty missiles were used for Navy Operational Evaluation, of which sixteen were fired. The Air Force used the remaining twenty missiles for IOT&E, firing sixteen of the twenty missiles. The joint test was completed in time for the Defense Systems Acquisition Review Council III in March 1983. The test program prior to Milestone III evaluated the pilot production missiles, avionics, peculiar ground support equipment and government furnished equipment against the full array of specification, operational effectiveness, and operational suitability requirements.

Budget Activity: 4, Tactical Programs
Program Element: 27162F, Tactical Air-to-Ground Missiles (AGM-88)

2. (U) Operational Test and Evaluation (OT&E): (U) Follow-on Operational Test and Evaluation (FOT&E) of the High Speed Antiradiation Missile (HARM) built by Texas Instruments, Lewisville, Texas, began 1 April 1984 and ends 30 June 1985. The purpose of FOT&E is to evaluate the effectiveness and reliability of production missiles, verify corrections to deficiencies identified during IOT&E, evaluate ground support equipment, and verify technical orders.

(U) An Air Force preliminary evaluation (AFPE) was conducted (Jan 79 - Oct 80) in combination with Development Test and Evaluation (DT&E), using prototype missiles to obtain early data on operational effectiveness and suitability. During DT&E eight missiles were fired from the F-4G Wild Weasel aircraft by operational aircrews from the Tactical Air Command. Navy and Air Force maintenance personnel monitored missile buildup, test, repair, and maintenance actions by the contractor.

(U) The Air Force HARM Initial Operational Test and Evaluation (IOT&E) was conducted from November 1981 to October 1982 in two phases. Phase I, which ended May 1982, consisted of six missile firings from the F-4G aircraft. Phase II, which began in June 1982, consisted of 12 missile firings to validate a software enhancement update to the missile (equations of motion). In addition, an extensive captive-carry flight program was conducted to evaluate missile effectiveness and reliability.

(U) The Air Force HARM FOT&E Phase I will be conducted in a two-phased approach. Both phases will utilize production missile and ground support equipment. All missiles will be integrated with the F-4G Wild Weasel. FOT&E Phase IA was conducted from 1 April 1984 to November 1984 and consisted of one missile firing. Additionally, an extensive captive-carry flight program will be conducted to evaluate production missile effectiveness and reliability. Phase IB will be conducted from 1 April 1985 to 30 June 1985 and will consist of five missile firings, one of which will be a live warhead firing. This phase will evaluate FY84 production software, which corrects the majority of deficiencies identified during IOT&E, and will be integrated with the first phase of the AN/APR-38 performance upgrade program (PUP) to the F-4G. Air Force testing will be conducted on test ranges at Nellis AFB, Nevada; Naval Weapons Center, China Lake, California; and White Sands Missile Range, New Mexico. USAF operational aircrews and maintenance personnel will be utilized throughout FOT&E.

(U) System performance and reliability criteria are outlined in Decision Coordination Paper 93B, which is presently under revision and service coordination.

(U) Operational Test and Evaluation (OT&E) reports published:

(1) (U) High Speed Antiradiation Missile (HARM) Air Force Preliminary Evaluation (AFPE), January 1981 (S).

(2) (U) High Speed Antiradiation Missile (HARM) IOT&E Final Report, April 1983 (S).

(3) (U) High Speed Antiradiation Missile (HARM) IOT&E Final Report Annex, May 1983 (S).

Budget Activity: 4, Tactical Programs
Program Element: 27162F, Tactical Air-to-Ground Missiles (AGM-88)

3. System Characteristics:

CHARACTERISTICS	MILESTONE IIB THRESHOLD	MILESTONE III THRESHOLD 1/	MILESTONE III GOAL 1/	DEMONSTRATED
Range:				
(Level Launch) Nautical Miles				
5,000 Ft Altitude				
15,000 Ft Altitude				
30,000 Ft Altitude				
Accuracy:				
Median of the Closest Point of Approach (in Feet)				
Frequency Coverage:				
(Gigahertz)				
Pulse				
Continuous Wave				
Technical:				
Length (Feet)	15	15	13	13.7
Diameter (Inches)	11	11	10	10.5
Weight (Pounds)	807	807	780	780
Time to Target (Level launch at 10,000 feet, 0.8 Mach to target at 10 nautical miles) (Seconds)				

Budget Activity: 4, Tactical Programs
Program Element: 27162F, Tactical Air-to-Ground Missiles (AGM-88)

CHARACTERISTICS	MILESTONE II B THRESHOLD	MILESTONE III THRESHOLD 1/	MILESTONE III GOAL 1/	DEMONSTRATED
Mean Flying Hours Before Failure (Hours) (Captive Carry over 1850 test hours, 1.8 flying hrs per sortie, including 1.0 hour full electrical power)	Not Applicable	125	181	55.5 4/
Reliability, Missile Captive Carry	Not Applicable	.75	.82	.99 4/ 5/
Reliability, Missile Free Flight	Not Applicable	.85	.95	.84 4/ 6/

1/. (U) DCP-93B Goals, 1 December, 1982

2/. (U) Includes Air Force and Navy Initial Operational and Test Evaluation (IOT&E) firings

3/. (U) Demonstration based on results of IOT&E

4/. (U) Results shown are based on the AFOTEC IOT&E report only and reflect Air Force results from a limited sample size of 943.7 missile flight hours.

5/. (U) Probability that High Speed Antiradiation Missile (HARM) will be up and ready for launch after 20 captive carry flights of 1.8 hours duration per mission with full electrical power applied for one hour per mission. Relates to a Mean Flying Hours Before Failure threshold of 125 hours and goal of 181 hours.

6/. (U) Given an up HARM system at launch, probability of successful launch, target guidance (including flex logic operation, if required) and proper fuze and warhead function within the specified Median of the Closest Point of Approach. Target is defined as any emitter having parametric characteristics similar (within missile radar frequency and search area discrimination limits) to one of the threat listings handed off by the avionics.

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
FOT&E Phase 1A	Apr - Sep 84	Apr - Nov 84	All effectiveness and reliability data collected. Live firing delayed due to instrumentation software change which caused a power drop-out problem. No impact on on operational aircraft.

T&E Activity (Next 12 Months)

Event	Planned Activity	Remarks
FOT&E Phase 1B	Apr - June 85	Start of FOT&E 1B delayed due to additional software changes which will require DT&E live firings.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27247F
DOD Mission Area: #322, TIARA for Tactical Land Warfare

Title: Air Force TENCAP
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		271	260	250	307	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program has as its main objective the development of procedures, tactics, and interface equipment/software to facilitate tactical use of national space systems within an operations framework. In 1977 Congress directed each service to establish a Tactical Exploitation of National Space Program Capabilities (TENCAP) office to improve military use of national systems. The FY 1985 funding and outyear programing provides continuing funding for this effort. Efforts will include evaluation and development of interfaces with national programs and enhancement of our tactically deployed forces through tactical exercises and improved interfaces with the intelligence community. This will include necessary software development, equipment evaluation, and related studies. Tactical impact statements will be prepared to document the utility of new programs to support tactical operations.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	271	260	255		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Will require interface with National space systems.

6. (U) WORK PERFORMED BY: Air Force management of this effort is under the Air Force Deputy Chief of Staff for Plans and Operations.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 27247F, AIR FORCE TENCAP

A. (U) Project Description: This program has as its main objective the development of procedures, tactics and interface equipment/software to facilitate tactical use of national space systems within an operational framework. Efforts will include participation in tactical exercises, system interface, software/hardware development and related developmental studies.

Program Element: #27247F — Title: Air Force TENCAP
DOD Mission Area: #322, TIARA For Tactical Land Warfare — Budget Activity: #4 - Tactical Programs

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Information on accomplishments in FY 1984 is available at higher security levels and a complete review of this program is available in the FY 1986 Intelligence Related Activities, Congressional Justification Book.

(2) (U) FY 1985 Program: The FY 1985 program will continue exercise evaluation, software development programs and equipment and procedure evaluation. Updating of Tactical impact statements (TIS) which document the tactical value of national systems will be initiated. A TENCAP dissemination demonstration will be conducted.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Ongoing efforts will be continued. A continued involvement in tactical exercises with the Central Command will be pursued. The FY 1986 cost estimates for these activities are based on the FY 1984 completed activities and projections for continuity into FY 1986. Program is managed as a level of effort.

(4) (U) Program to Completion: Continuing.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27411F
DOD Mission Area: #352 - Air Warfare

Title: Overseas Air Weapons Control Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,280	3,154	3,068	1,299	Continuing	N/A
2704	EIFEL Follow-On	1,930	1,804	1,768	0	Continuing	N/A
2026	Air Command and Control System (ACCS)/European Theater Air Command and Control Study (ETACCS)	1,350	1,350	1,300	1,299	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: EIFEL is an automated command and control system, for the United States Air Force operated Allied Tactical Operations Center (ATOC) at Sembach, Germany. Under the EIFEL Follow-On effort, the United States Air Force will cooperate with the Federal Republic of Germany in the joint development of a follow-on system to augment and expand the current EIFEL I system from the ATOC down to the wing/squadron level. The European Theater Air Command and Control Study (ETACCS) has been established to analyze and coordinate the accomplishments of the NATO team working on the NATO Air Command and Control System (ACCS) and to develop U.S. coordinated position relative to ACCS issues.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	3,280	3,154	3,135		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Not Applicable

6. (U) WORK PERFORMED BY: The EIFEL Follow-On effort is being accomplished by the Air Force Systems Command (AFSC), Andrews AFB, MD. Mitre Corporation, Bedford, MA will provide technical support in this effort. The Air Force role in European Theater Command and Control System (ETACCS) will be accomplished by AFSC and Tactical Air Forces Interoperability Group (TAFIG). The Institute of Defense Analyses (IDA), Alexandria, VA and Mitre will provide technical support.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2704, EIFEL Follow-On. The purpose of the EIFEL system is to automate the command and control of tactical offensive air functions in the Central Region of NATO. The current EIFEL I system provides an initial capabil-

ity but does not provide automation at the unit level or the communications network necessary to provide NATO interoperability, succession of command, and survivability. The EIFEL Follow-On effort will correct these deficiencies. In FY 1984, planning activities were initiated. In FY 1985, initial development activities will commence, including a unit level automation test bed. Also, in FY 1985 a Memorandum of Understanding (MOU) between the United States and the Federal Republic of Germany will be negotiated and a joint program office will be established. In FY 1986, the MOU will be signed, additional software will be developed for the Allied Tactical Operation Center level system and a local area network will be developed for the unit level.

B. (U) Project: 2026, Air Command and Control System (ACCS)/European Theater Air Command and Control Study (ETACCS). The Air Force will continue to provide administrative funding for the U.S. representatives on the Air Command and Control System (ACCS) team. The ACCS team has been tasked to design an air command and control system for NATO. The ETACCS program studies the issues raised by the ACCS team and develops U.S. staffed and coordinated positions. In FY 1985 through FY 1987, NATO proposals for improving air command and control will be analyzed and issues identified. ETACCS issue subgroups will be formed and desk top studies will be conducted. U.S. proposals for improving the USAF command and control system will be analyzed and evaluated in relation to the NATO proposals. U.S. goals, objectives and plans for improvement in the European theater will be developed.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27412F
DOD Mission Area: #352 - Air Warfare Command and Control

Title: Tactical Air Control System
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT	8,553	24,339	20,075	18,523	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Tactical Air Forces require a highly developed, reliable, positive control system to fully exploit the inherent capabilities of tactical air power. The Tactical Air Control System (TACS) provides the means through which the Air Force Component Commander exercises control of his forces to accomplish his assigned mission. This program provides for major improvements to the existing TACS which was deployed in the sixties and is nearing the end of its useful life. Some of the programs include developing a new transportable modularized, software intensive, automated air command and control system and a series of electronic countermeasure programs to enhance the survivability and capabilities of the AN/TPS-43E TACS radar. The TACS improvement program is made up of the following efforts:

- System Trainer and Exercise Module (STEM)
- Modular Control Equipment (MCE)
- MCE Preplanned Product Improvement Program (P^3I)
- Ground Attack Control Capability (GACC)
- Ultra Low Sidelobe Antenna (ULSA)
- Anti-Radiation Missile Alarm Sensor (ARM Alarm)
- Anti-Radiation Missile Decoy (ARM Decoy)
- Joint Operational Interface Simulation Training System (JOISTS)

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	8,553	28,397	22,870	-	Continuing	N/A
Other Procurement	28,527	14,911	104,914	-	Continuing	N/A

RDT&E

Congressional reduction of funds by $4.0 Million in FY 1985.
Adjustment to FY 1985 President's Budget deferred $5 Million in FY 1986 to FY 1987 on the ARM Decoy program, and an additional $3 Million was reduced in FY 1986 to reflect a rephasing of all of the TACSI development programs.
Added $5.6 million in FY 1986 and $3.8 million in FY 1987 to start full scale research, development, and acquisition of JOISTS.

Program Element: #27412F Title: Tactical Air Control System
DOD Mission Area: #352 - Air Warfare Command and Control Budget Activity: #4 - Tactical Programs

Other Procurement

In FY 1984 $4.8 Million was reprogrammed to acquire five more System Trainer & Exercise Modules (STEM) and $1.5 Million was added to the Ultra Low Sidelobe Antenna (ULSA) program.
In FY 1985 an additional ULSA will be acquired due to reduced unit cost.
In FY 1986 the quantities for Modular Control Equipment (MCE) was reduced from 6 to 4 units based upon a better estimate of the non-recurring and production start-up costs.
In FY 1986 an additional $13 Million was added to acquire six more ULSAs.
In FY 1986 $3 Million was changed from prime mission equipment to spares.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement Funds	34,810	14,727	115,476	209,698	Continuing	N/A
(Quantity) System Trainer and Exercise	(15)					
Ultra Low Sidelobe Antenna	(6)	(7)	(9)	(20)		
Modular Control Equipment			(4)	(15)		
Anti-Radiation Missile Alarm			(22)	(43)		

5. (U) RELATED ACTIVITIES: The Modular Control Equipment (MCE) program is a joint program with the United States Marine Corps (USMC) Tactical Air Operations Central (TAOC) program. The MCE/TAOC contracts are administered by the USMC Systems Project Office, Naval Electronic Systems Command (NAVELEX PDE-154) according to the 26 Jul 82 "Memorandum of Agreement between NAVELEX PDE-154 and the Electronic Systems Division Tactical Air Battle Management Systems Program Office (ESD/TCR) regarding the TAOC/MCE Full Scale Engineering Development Effort." The MCE program will have as one of its MCE Preplanned Product Improvement Program (P^3I) efforts the capability to interface with the Joint Tactical Information Distribution System Class 2 Terminal (PE 64754F). The Ground Attack Control Capability program will work closely with the Joint Surveillance and Target Attack Radar System program (PE 64770F) in controlling the air attack of time sensitive mobile ground targets. The Joint Operational Interface Simulation Training System (JOISTS) is a four Service program supporting the United States Readiness Command sponsored training.

6. (U) WORK PERFORMED BY: Electronic Systems Division, Tactical Air Battle Management System Program Office, Hanscom Air Force Base, MA, manages this program. Rome Air Development Center, Griffiss AFB, NY, and the Tactical Air Command, Langley Air Force Base, VA, provide engineering and operational support respectively. Major contractors include GTE Sylvania, Needham Heights, MA (STEM); Westinghouse Corp., Baltimore, MD (ULSA); Litton Data Systems, Van Nuys, CA (MCE); Sanders Associates, Nashua, NH (ARM Alarm); and MITRE Corp., Bedford, MA (Systems Engineering).

Program Element: #27412F
DOD Mission Area: #352 - Air Warfare Command and Control

Title: Tactical Air Control System
Budget Activity: #4 - Tactical Programs

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 27412F, Tactical Air Control System Improvements (TACSI)

A. (U) Project Description: The Tactical Air Control System (TACS) Improvement program consists of several ongoing research and development and production programs. The System Trainer and Exercise Module (STEM) provides a trainer to run scenarios and exercises for components of the TACS. The Modular Control Equipment (MCE) will provide modular replacement units for the aging and obsolescent radar operations shelters and ancillary equipment at the Control and Reporting Centers/Control and Reporting Posts (CRCs/CRPs) and Forward Air Control Posts of the TACS. It will enhance the TACS survivability, mobility and provide the ability to handle the greatly increased command, control, and communications (C^3) workload required in a modern combat environment. The MCE Preplanned Product Improvement (P^3I) program will incorporate phased improvements to the basic MCE system so that the MCE functions will keep pace with the changing Tactical Air Control System environment. The Ultra Low Sidelobe Antenna (ULSA), the Anti-Radiation Missile Alarm Sensor (ARM Alarm), and the Anti-Radiation Missile Decoy (ARM Decoy) are three efforts to enhance the survivability and effectiveness of the AN/TPS-43E radar, also known as SEEK SCREEN. The ULSA program provides a new antenna for the AN/TPS-43E radar that reduces its susceptibility to being targeted by anti-radiation missiles and increases its capability against jamming. The ARM Alarm program will warn the radar operators of an approaching anti-radiation missile in time to automatically initiate appropriate countermeasure actions. The ARM Decoy program will then lure the incoming anti-radiation missiles away from the radar. The Ground Attack Control Capability (GACC) program will provide the TACS with the capability to control the air attack of time sensitive mobile ground targets. The GACC will employ MCE hardware. The Joint Operational Interface Simulation Training System (JOISTS) will provide data link training by disseminating an air picture among command and control facilities.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: In FY 1984 the Air Force awarded the STEM production contract; negotiated the ULSA production contract; started in plant Development Test and Evaluation (DT&E) of the MCE program; and continued the ARM Alarm development efforts.

(2) (U) FY 1985 Program: The plan for FY 1985 is to take delivery of the STEM production units; award the ULSA production contract (October 1984): conduct the MCE Initial Operational Test and Evaluation (IOT&E); finish the basic MCE research and development; prepare for MCE production; conduct ARM Alarm DT&E; and start research and development on the ARM Decoy, MCE P^3I and GACC programs. For the ARM Decoy, the Air Force will develop specifications and other documentation required to prepare the request for proposal to industry to support full scale development. Contract award is estimated for June 1985. For the MCE P^3I program, the Air Force will finalize P^3I integration plans and develop the documentation required to prepare the request for proposal to start the hardware and software development efforts. Contract award for the preliminary design work is scheduled for February 1985 with a follow-on

design contract award scheduled for later in the fiscal year. For the GACC program, the Air Force will develop interface and integration plans, system designs and support documentation required to incorporate the GACC into the Tactical Air Control System; and prepare the request for proposal for full scale development.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The plan for FY 1986 is to continue full scale development of the Anti-Radiation Missile (ARM) Decoy, Modular Control Equipment (MCE) Preplanned Product Improvement Program (P^3I), and Ground Attack Control Capability (GACC) programs; start the MCE and ARM Alarm production programs and continue ULSA production. In FY 1986, the ARM Decoy will finish system design, undergo design reviews, and finish system integration. For the MCE P^3I program the efforts include system design, design reviews and start of hardware and software integration for improvements to the basic MCE. Some of these improvements include: updating the MCE software to use the latest Joint Tactical Air Operations message standards; interfacing the MCE with the new Ultra Low Sidelobe Antenna (ULSA) equipped AN/TPS-43E tactical radar; integrating HAVE QUICK antijam radios into the MCE; interfacing the MCE with the Joint Tactical Information Distribution System; and adding a chemical/biological/radiological protection capability. The GACC full scale development contract will begin in FY 1986 at which time the modification of the MCE software to provide GACC will begin. In addition to designing the GACC software, interfaces to new sensor system such as Joint Surveillance and Target Attack Radar System and other command and control elements, such as the Enemy Situation Correlation Element of the Joint Tactical Fusion program, will be developed. The Joint Operational Interface Simulation Training System (JOISTS) research and development effort will begin in FY 1986. The cost estimate for the MCE P^3I program is a Category IV, the ARM Decoy cost estimate is a Category III estimate, the GACC cost estimate is a Category V estimate, and the JOISTS cost estimate is a Category IV estimate.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

	PROGRAM	R&D CONTRACT AWARD	START FIELD DT&E	START IOT&E	PRODUCTION * CONTRACT AWARD	INITIAL DELIVERY DATE
(1) (U)	STEM	OCT 78	NOV 82	MAR 83	DEC 83	**(DEC 84) JAN 85
(2) (U)	ULSA	AUG 80	SEP 82	JAN 83	OCT 84	MAY 86
(3) (U)	ARM Alarm	JUN 83	**(JUL 84) JUL 85	**(APR 85) OCT 85	JUN 86	**(FY 87) FY 88
(4) (U)	ARM Decoy	JUN 85	2Q FY 87	4Q FY 87	2Q FY 88	FY 89
(5) (U)	MCE	JUL 82	**(OCT 84) JUN 85	**(DEC 84) SEP 85	JUN 86	**(FY 88) OCT 88
(6) (U)	MCE P^3I	**(JUN 85) FEB 85	**(2Q FY 88) 4Q FY 88***	**(4Q FY 87) 1Q FY 89***	MAR 86****	**(FY 88) FY 89
(7) (U)	GACC	1Q FY 86	4Q FY 87	2Q FY 88	N/A	FY 89
(8) (U)	JOISTS	1Q FY 86	TBD	TBD	N/A	FY 89

*Production decision changed to production contract award to provide more meaningful milestone
**Date presented in Fiscal Year 1985 Descriptive Summary
***For software improvements
****For hardware improvements

Program Element: #27412F
DOD Mission Area: #352 - Air Warfare Command and Control

Title: Tactical Air Control System
Budget Activity: #4 - Tactical Programs

(U) EXPLANATION OF MILESTONE CHANGES

(1) (U) Initial delivery delayed one month because of problems encountered in starting production.
(3) (U) The program delayed 6 months because of technical and subcontractor problems.
(5) (U) The testing was delayed 8 months because of software and hardware integration problems.
(6) (U) Start of preliminary design contract moved up to incorporate hardware changes into the basic hardware production effort, software testing rescheduled to more realistic dates.
(8) (U) New program addition to the Tactical Air Control System.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27417F
DOD Mission Area: #352 - Air Warfare

Title: Airborne Warning and Control System
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		75,350	74,522	137,302	110,894	240,226	2,193,644

NOTE: Large aircraft terminal development for the Joint Tactical Information Distribution System (PE 64754F) is funded in PE 27417F.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The main purpose of this program is the development of system improvements which will enable the United States (U.S.) to maintain, in a changing threat environment, the E-3 as an effective, survivable airborne surveillance system for command and control of tactical forces and strategic defense of the U.S. The E-3 Airborne Warning and Control System (AWACS) overcomes ground based surveillance system deficiencies through its unique ability to provide extended all altitude surveillance and, for the first time, the means to manage an air battle situation in real time. It is contributing significantly to a more effective integration of the capabilities of U.S. forces supporting United States, North Atlantic Treaty Organization or other worldwide requirements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	63,360	76,595	101,951		188,118	1,985,600
Aircraft Procurement						
Funds	76,200	0	0		19,700	2,762,600
Quantities	0	0	0		0	31

RDT&E: In FY 1984, a below threshold reprogramming of $3.99 million and a Congressional reprogramming of $8 million added a total of $11.99 million to accelerate development of a communications electronic counter-countermeasure capability (HAVE QUICK A-Net) for the E-3. $2 million is deleted in FY 1985 as a result of the FY 1985 Appropriation Bill. $12.8 million is also added in FY 1986 for HAVE QUICK A-Net, a Quick Reaction Capability (QRC) program. In FY 1986, $25.8 million is added for development of an Electronic Support Measures (ESM) addition to the E-3 Surveillance System, which will provide the E-3 with a passive detection, location and identification capability and greatly improve E-3 capability in a dense electronic countermeasure environment. The estimated costs for the other FY 1986 projects were

reduced as a result of an adjustment in inflation indices. The remaining increase to total estimated cost is a result of development of Electronic Support Measures (ESM), development of a permanently installed satellite communications system (AFSATCOM) for the E-3, completion of the Improved Radar Data Correlator (IRDC) development and continuation of E-3 sustaining engineering activities.

Procurement: The procurement funding decrease in FY 1984 is a result of a decision not to use advance procurement funds to maintain an E-3 production capability into FY 1986. The remaining decrease in total estimated cost is the result of FY 1983 and prior year negotiation gains, refinement of requirements, and underruns, which were realized subsequent to the submission of the FY 1985 President's Budget.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	9,300	0	0	19,900	0	2,668,100
Quantities	0	0	0	0	0	0

5. (U) RELATED ACTIVITIES: The Overland Radar Technology Program (Program Element 63701F) proved the feasibility of overland radar in support of an airborne warning and control system. The North Atlantic Treaty Organization Airborne Early Warning and Control System (Program Element 64752F) was established in FY 1978 to fund the United States share of the North Atlantic Treaty Organization development effort (subsequently changed to Program Element 01012F). The foreign military sale of the E-3A to Saudia Arabia was approved in October 1981. Development of the Joint Tactical Information Distribution System (JTIDS) Class 2 terminal required for implementation of the Tactical Data Information Link (TADIL) J standard message format in the E-3 is being accomplished under Program Element 64754F, Joint Tactical Information Distribution System. Development of Global Positioning System (GPS) user equipment required for implementation in the E-3 is being accomplished under Program Element 35164F, Navstar GPS User Equipment. Development of Enhanced JTIDS System (EJS) and Single Channel Ground and Airborne Radio System (SINCGARS) equipment required for implementation in the E-3 is being accomplished under Program Element 27423F, Advanced Communication Systems. Development of HAVE CHARCOAL, an infrared self-protection system required for the E-3, is being accomplished under PE 64739F, Tactical Protective Systems.

6. (U) WORK PERFORMED BY: The Air Force management is provided by the Electronic Systems Division, Hanscom AFB, Bedford, MA. The major contractors are Boeing Aerospace Company, Seattle, WA (Air Vehicle and Integration); Westinghouse Electric Corporation, Baltimore, MD (Radar); International Business Machines, Owego, NY (Data Processor); Hazeltine Corporation, Long Island, NY (Displays); Hughes Aircraft Company, El Segundo and Fullerton, CA (Communications and Joint Tactical Information Distribution System Digital Data Link); Pratt and Whitney Aircraft Division of United Aircraft Corporation, Hartford, CT (Engines). Twelve additional contracts total $95.5 million.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION FUNDING IN FY 1986:

(U) Project: Airborne Warning and Control System

A. (U) Project Description: The E-3 Airborne Warning and Control System will support a variety of tactical air operations and the air defense of the continental United States. It will overcome current deficiencies of present ground-based systems (range, vulnerability, limited effectiveness against low altitude targets and susceptibility to electronic countermeasures). The capability to detect and track targets against ground clutter makes the E-3 effective against low altitude targets. Since the radar is mounted on a high flying jet aircraft, increased surveillance volume and detection range are realized. Mobility, coupled with the awareness of potential threats, and the ability to command weapons in its own defense, make the E-3 highly survivable.

The airborne platform is a Boeing 707 aircraft equipped with radar, communications, identification sensors, navigation units and data processors to provide an integrated presentation of the air situation on operator display consoles. Software changes in the central processor configure the E-3 for tactical or strategic defense missions. The E-3 is capable of detecting and tracking low flying aircraft targets in the presence of ground clutter, detecting bomber aircraft at a distance of [ ] nautical miles, detecting tactical aircraft up to [ ] nautical miles, computer tracking of up to] targets, 6.2 hours on station time at 1000 nautical miles from base, and active interrogation of aircraft using a cooperative beacon in cryptological secure or standard modes. Command and control improvements as well as electronic counter-countermeasures improvements are planned for the E-3 to exploit its inherent capabilities and to keep pace with the evolving threat.

(U) The E-3 significantly enhances the combat effectiveness of air, ground and naval forces. Strategic defensive forces will utilize the E-3, in conjunction with interceptor forces, for the wartime defense of the continental United States and as an integral element of the mobile air defense force for contingencies requiring air defense outside the United States. Tactical forces will use the E-3 for command and control during the deployment of tactical air forces; and in accomplishing interdiction, rescue and airlift missions. Its flexibility and versatility will enable it to be deployed at any level of military action ranging from a show of force through general war. During these deployments, the means will exist, for the first time, to manage the air and sea battle.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Full scale development (FSD) continued on the integration of additional radios and multipurpose consoles into the E-3 as well as FSD for an electronic counter-countermeasures improvement. As part of the process of incorporating new technologies into the E-3 to assure its resistivity to the evolving electronic countermeasures threat, full scale development began for a communications electronic counter-countermeasure design

(HAVE QUICK A-Net) [ ] Validation continued for the Improved Radar Data Correlator which is needed to correct maintainability problems and to provide for additional computing capacity for planned improvements. Full scale development (FSD) began for the Mission Simulator Improvement Program, which is now called the Trainer External Simulation System (TESS) Program. TESS will provide a much needed expansion in training capability thus allowing an increase in the quantity and quality of mission crew training.

(2) (U) FY 1985 Program: Full scale development and flight testing to integrate additional radios and multipurpose consoles into the E-3 and FSD for an electronic counter-countermeasures improvement will be completed. Development of the communications electronic counter-countermeasure improvement (HAVE QUICK A-Net) will continue. Development will continue for the TESS program. Validation for the Improved Radar Data Correlator will continue and FSD will be initiated for correction of the Identification, Friend or Foe (IFF) jitter problem which severely impacts the man-machine interface. Integration of Joint Tactical Information Distribution System (JTIDS) Tactical Data Information Link (TADIL) J will begin which will provide for secure, jam-resistant communications with the fighter force.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Full scale development and flight testing of the communications electronic counter-countermeasures improvement (HAVE QUICK A-Net) will be completed. The validation phase for the Improved Radar Data Correlator and FSD for the TESS will be completed. FSD for correction of the IFF jitter problem and integration development of JTIDS TADIL J will continue. Integration of improvements to HAVE QUICK will begin. FSD will begin for an Electronic Support Measures (ESM) addition to the E-3 Surveillance System, which will provide the E-3 with a passive detection, location and identification capability against airborne, shipborne and ground-based emitters. Fiscal year 1986 cost estimates are based on firm contract prices and program office estimates.

(4) (U) Program to Completion: Concludes development and testing of the solution to the IFF jitter problem and integration of TADIL J, ESM and HAVE QUICK improvements into the E-3. FSD of the Improved Radar Data Correlator and integration of a self-defense system (HAVE CHARCOAL) will begin. Development will begin for integration of a permanently installed satellite communications system (AFSATCOM) for the E-3. These efforts will be completed by the end of FY 1991.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Engineering Development Contract Award	July 1970
(2) (U) First Flight (Brassboard)	March 1972
(3) (U) End of Flight Test of Brassboard	August 1972
(4) (U) Start of Development Test and Evaluation	January 1973

(5)	(U) System Demonstration Flight Tests Begin		March 1974
(6)	(U) System Demonstration Test and Evaluation Completed		December 1974
(7)	(U) Start of Production		March 1975
(8)	(U) First Test Flight of First Development, Test and Evaluation Aircraft		August 1975
(9)	(U) Development Flight Test Complete (Core)		January 1977
(10)	(U) Interim Operational Capability (Core)		April 1978
(11)	(U) Maritime Radar Flight Test Complete		July 1980
(12)	(U) Standard Configuration Flight Test Complete		October 1981
(13)	(U) Command and Control Improvements Flight Test Complete		March 1984
(14)	(U) Last United States (U. S.) Production Aircraft Delivered	*(May 1984)	June 1984
(15)	(U) Improved Radar Data Correlator Validation Phase Complete		August 1986
(16)	(U) Trainer External Simulation System (TESS) Installation and Checkout Complete		January 1986
(17)	(U) HAVE QUICK A-Net Flight Test Complete		May 1986
(18)	(U) Electronic Support Measures (ESM) Flight Testing Complete		May 1987
(19)	(U) Identification, Friend or Foe (IFF) Jitter Flight Test Complete		October 1987
(20)	(U) Tactical Data Information Link (TADIL) J Flight Test Complete		January 1988

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) EXPLANATION OF MILESTONE CHANGES

(14) Delivery of the last U.S. production aircraft slipped one month due to problems encountered during acceptance testing.

Budget Activity: 4, Tactical Programs
Program Element: 27417F, Tactical Airborne Command and Control System (E-3A)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The E-3A Development Test and Evaluation test program was combined with Initial Operational Test and Evaluation test objectives in as realistic an operational environment as possible. The prime development contractor is The Boeing Company. The overall objectives of the test effort were to: (a) validate/verify E-3A performance in accordance with design specifications; (b) determine E-3A performance and capability to fulfill operational requirements including interservice interoperability demonstrations; and (c) verify Air Force capability to support the E-3A with standard operational maintenance, logistics and training units using prescribed procedures. The first phase of three Development Test and Evaluation phases used a Brassboard engineering model and tested the airworthiness of the rotodome, demonstrated the feasibility of competing overland radar technologies (Hughes and Westinghouse) and demonstrated successful integration of radar targets and computer display equipment. This phase was flown from March through November 1972, and resulted in Westinghouse being selected to continue radar development.

2. (U) Operational Test and Evaluation (OT&E): The E-3A test program has been conducted as a combined Development Test and Evaluation/Initial Operational Test and Evaluation (IOT&E).

(U) Core E-3A Follow-on Operational Test and Evaluation

(U) General. The E-3A test program was conducted as a combined development test and evaluation/initial operational test and evaluation (DT&E/IOT&E).

(U) Core E-3A Follow-on Operational Test and Evaluation (FOT&E). FOT&E, initiated in January 1977, was conducted in two phases with operational crews using production aircraft, training equipment, and support equipment.

(U) FOT&E Phase I, managed by the Air Force Operational Test and Evaluation Center (AFOTEC), was completed in February 1978. The results of the first phase of follow-on operational test and evaluation (FOT&E) were reported in the AFOTEC Airborne Warning and Control System (AWACS) FOT&E Phase I Final Report, July 1978. Test results confirmed that the production E-3A can effectively and efficiently perform its prescribed mission and that the E-3A will greatly enhance the capability of the Air Force to conduct tactical air operations. However, several significant reliability and maintainability problems and deficient logistic support areas were identified for improvement.

Budget Activity: 4, Tactical Programs
Program Element: 27417F, Tactical Airborne Command and Control System (E-3A)

(U) FOT&E Phase II, managed by the Tactical Air Command, was initiated in March 1978 to refine initial operational test and evaluation (IOT&E) and Phase I FOT&E assessments with emphasis on tactics and procedures. This testing was completed during May 1980. Test reporting by the United States Air Force Tactical Fighter Weapons Center was accomplished in two parts. Part A of the final report covering the period March 1978 - May 1979 was published in May 1980 titled, Volume I, E-3A Airborne Warning and Control System (AWACS) Follow-on Operational Test and Evaluation (FOT&E), Phase II. Part B was published in October 1980 titled, Volume II, E-3A Airborne Warning and Control System (AWACS) Follow-on Operational Test and Evaluation (FOT&E), Phase II. A separate built-in-test/fault-isolate test report by the United States Air Force Tactical Fighter Weapons Center was published in June 1981 titled, Final Report, E-3A Surveillance Radar Built-In-Test (BIT)/Fault-Isolate-Test (FIT) Evaluation.

(U) E-3A Enhancements IOT&E. Decision Coordinating Paper (DCP) 5, Revision 3, 5 March 1976, approved continued production of the E-3A, and the development of a selected set of system enhancements chosen to provide a fully effective worldwide force. The enhancements were to be developed as separate entities and integrated into the E-3A for testing as the enhancement items became available. In May 1976, the Deputy Secretary of Defense directed the Air Force to plan for an OSD review of the AWACS enhancement program when the respective enhancement development efforts are essentially completed. He further stated that it is contemplated that the Defense Systems Acquisition Review Council (DSARC) would then review development and test status and consider the operational utility of the respective enhancements in light of an updated threat evaluation prior to committing the government to production. The purpose of operational testing of the enhancements was to provide an evaluation of the operational utility of each enhancement for the DSARC review. In December 1978, the North Atlantic Treaty Organization (NATO) signed an agreement with the US Government (as their agent) for the procurement of 18 E-3A aircraft. To support this commitment and the US standard configured E-3A aircraft, the Air Force received the approval of the the Office of the Secretary of the Defense (OSD) for limited production authority for a maritime surveillance capability (MSC) radar and a Joint Tactical Information Distribution System (JTIDS) capability in E-3 DCP, No. 5, Revision IV, 6 March 1980. Results of the JTIDS test were reported in the December 1978 Air Force Test and Evaluation Center (AFTEC) E-3A Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal Initial Operational Test and Evaluation Report. The IOT&E of the US Standard E-3A and the Continental United States portion of the North Atlantic Treaty Organization (NATO) E-3A was conducted by the Air Force Test and Evaluation Center (AFTEC) from 15 September through October 1981. The results of this effort were reported in the AFTEC US/NATO E-3A IOT&E Final Report, March 1982. Overall operational effectiveness and suitability were satisfactory and the US/NATO E-3A, as tested, supported the user's operational requirements.

(U) The Block 20/25 Modification program retrofits Block 01 (Core) and Block 10 (Standard) configured E-3As. Block 20 will consist of Block 01 plus JTIDS, computer modification, 1 high frequency (HF) radio, 5 ultra-high frequency (UHF) radios, and 5 situation display consoles (SDCs). Block 20 aircraft have been redesignated E-3B aircraft. Block 25 will consist of Block 10 plus 5 UHF radios and 5 SDCs. Block 25 aircraft have been redesignated E-3C aircraft. Initial operational test and evaluation (IOT&E) of the Block 20/25 configuration is not required due to similarity with the Block 10 configuration which has completed operational tests.

Budget Activity: <u>4, Tactical Programs</u>
Program Element: <u>27417F, Tactical Airborne Command and Control System (E-3A)</u>

The Electronic Support System (ESS) is being installed in the E-3 in order to provide AWACS with an alternate source of [ ] The ESS consists of hardware developments and software modifications. The hardware [ ] and processes them to provide aircraft position reports to the E-3. The software modifications permit the AWACS Airborne Operational Computer Program to receive and process ESS reports in the same manner that it handles radar or Identification Friend or Foe (IFF) reports. ESS reports are displayed along with other sensor data on the E-3 situation display consoles. IOT&E for ESS was divided into three phases because there were significant software differences in the Core, Standard and Block 20/25 Data Analysis Processing Groups. Results of this testing will be available in 1985.

(U) Published OT&E Reports:

(1) <u>AWACS IOT&E Final Report</u>, November 1974, (S).

(2) <u>AWACS Free Play Test</u>, June 1975, (S).

(3) <u>AWACS Special IOT&E</u>, July 1975, (S).

(4) <u>AWACS Phase III IOT&E Final Report</u>, September 1977, (S).

(5) <u>AWACS FOT&E Phase I Final Report</u>, July 1978, (S).

(6) <u>E-3A Joint Tactical Information Distribution System (JTIDS) Terminal IOT&E Final Report, December 1978</u> (S)

(7) <u>Vol I, E-3A, AWACS FOT&E Phase II</u>, May 1980, (S).

(8) <u>E-3A Maritime Surveillance Capability (MSC) Preliminary Operational Effectiveness Assessment Report</u>, October 1980, (S).

(9) <u>Vol II, E-3A AWACS FOT&E, Phase II</u>, March 1981, (S).

(10) <u>Final Report, E-3A Surveillance Radar Built-in-Test (BIT)/Fault-Isolate-Test (FIT) Evaluation</u>, June 1981, (U).

(11) <u>US/NATO E-3A IOT&E Final Report</u>, March 1982, (S).

3. (U) <u>Systems Characteristics</u>

(U) <u>Comparison</u>: System Integration Demonstration (Test System 1)/Production

Budget Activity: 4, Tactical Programs
Program Element: 27417F, Tactical Airborne Command and Control System (E-3A)

(U) GENERAL	TEST SYSTEM #1	E-3A/CORE	E-3A/STANDARD
Crew Size	11	17	17
Production or Production Prototype Systems	NO	YES	YES
Radar	YES	YES	YES
(U) Navigation	YES	YES	YES
Data Processor	YES	YES	YES
Display	YES	YES	YES
Identification Friend or Foe	YES	YES	YES
On-Board Test Maintenance and Monitor	YES	YES	YES
Communications	PARTIAL	YES	YES

(U) HARDWARE	TEST SYSTEM #1	E-3A/CORE	E-3A/STANDARD
Consoles	4	9	9
Auxiliary Display Unit	1	2	2
Ultra High Frequency Radios	4	14	14
High Frequency Radios	1	2	3
Very High Frequency/Amplitude Modulation Radios	2	3	3
Very High Frequency/Frequency Modulation Radios	0	1	1

CAPABILITY	TEST SYSTEM #1	E-3A/CORE	E-3A/STANDARD
Radar Targets/Scan			
Identification Friend or Foe Targets/Scan			
Data Processing Track Capacity			
Data Processing Simultaneous Intercept			

Comparison: E-3A Core (Block 01) Requirements to Demonstrated Performance

TECHNICAL CHARACTERISTICS	E-3A CORE REQUIREMENTS	DEMONSTRATED PERFORMANCE
Detection Range (0.9 Probability in 1 Minute)		
High Altitude Bomber (Nautical Miles)		
Low Altitude Fighter Over Land (Nautical Miles)		

Budget Activity: 4, Tactical Programs
Program Element: 27417F, Tactical Airborne Command and Control System (E-3A)

TECHNICAL CHARACTERISTICS	E-3A CORE REQUIREMENTS	DEMONSTRATED PERFORMANCE
Crew Size	17	17
System Track Capacity		
Simultaneous Intercepts		
Targets Position Accuracy (Nautical Miles)		
Time on Station at 1000 Nautical Miles from Base in hours	6.1	6.2

(U) RELIABILITY AND MAINTAINABILITY CHARACTERISTICS

Probability of Completing 9 Hour Mission	0.88	0.88
Maintenance Manhour/Flight Hour	28.0	33.3*
In-Commission Rate	80%	95.7%
Probability of Fault Detection	95%	97%
Probability of Fault Isolation (To 3 Primary Units)	90%	95%
Turn Around Time	90% in 5.5 hrs	90% in 4.8 hrs
Probability of not Detecting Failure	0.08	0.03

*Actual data experienced during FY 1983 for all E-3A aircraft (includes Core and Standard configurations) delivered to TAC.

(U) Comparison: E-3A Standard (Block 10) Design Requirements to Demonstrated Performance

TECHNICAL CHARACTERISTICS	THRESHOLD	GOAL	DEMONSTRATED PERFORMANCE
Maritime Surveillance Capability			
Maximum Detection Range (Nautical Miles)			
Fast Patrol Boat			
Destroyer			
Maritime Targets Tracking Accuracy			
Position (Nautical Miles)			
Heading (Degrees)			
Speed (Knots)			
Maritime Targets Position Accuracy with Electronic Countermeasures (Nautical Miles)			

Budget Activity: 4, Tactical Programs
Program Element: 27417F, Tactical Airborne Command and Control System (E-3A)

TECHNICAL CHARACTERISTICS	THRESHOLD	GOAL	DEMONSTRATED PERFORMANCE
Maritime Targets Detection Range with Electronic Countermeasures (Nautical Miles)			
Maritime Target/Land Resolution (Nautical Miles)			
Joint Tactical Information Distribution System			
Message Transfer Ratio (Percent)			
Electronic Counter-Countermeasure Margin (Decibels)†			
Net Initialization Time (Minutes)			
Net Entry Time (Minutes)			
Terminal Initialization Time (Minutes) Automatic			

* Sea states were defined as M-moderate (1-5ft), R-rough (5-8ft), VR-very rough (8-12ft), and H-high (over 12ft).
** Not obtained during Initial Operational Test and Evaluation conducted 15 September to 30 October 1981.
† Mode 1 double pulse continuous full band average jammer power divided by average signal power.
†† Estimated based on manual initialization time of

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
Electronic Surveillance System (ESS) Phase I	Feb - Apr 84	Apr - Aug 84	Schedule slip caused by the contractor underestimating the magnitude of the software development task and by the requirement to solve a radio frequency signal processing problem. Fixes were identified and implemented.
ESS Phase II	Apr 84 - Jul 84	Oct 84 - Dec 84	Schedule slip was due to the contractor underestimating the development task required to integrate the ESS software into the E-3 airborne operational computer program. In addition the slip in the Phase I program impacted the Phase II schedule.

Budget Activity: 4, Tactical Programs
Program Element: 27417F, Tactical Airborne Command and Control System (E-3A)

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
Electronic Surveillance System Phase III	4th Qtr 85	

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 27419F
DOD Mission Area: #352 - Air Warfare

Title: Tactical Airborne Command and Control Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	8,151	0	0	8,151
3170	ABCCC Capsules	0	0	8,151	0	0	8,151

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Tactical Airborne Command and Control Systems are integral elements of the USAF Tactical Air Control System (TACS) and include the Airborne Battlefield Command and Control Center (ABCCC) and Tactical Deployment Control Aircraft (TDCA). The ABCCC is a key element in the TACS due to its mobility and capability to provide battle management for tactical air forces supporting worldwide unilateral, joint and/or combined operations. The ABCCC may be employed in the absence of ground based TACS elements or in conjunction with the TACS as a direct extension of the Tactical Air Control Center/Allied Tactical Operations Center (ATOC) Combat Operations Division, or as a limited Airborne Air Support Operations Center (ASOC). The ABCCC function is performed within a capsule carried by a specially configured EC-130E. The ABCCC has been particularly useful as the on scene command element for crisis management and contingency operations. The ABCCC program was initiated in the mid-1960s. The new ABCCC capsule information provided is for an FY 86 new start.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	0	0	0	12,500	31,500	44,000
Quantities	0	0	0	1	6	7

5. (U) RELATED ACTIVITIES: The ABCCC requirements and technical approach are being worked in concert with the Advanced Communication Systems program element (PE 27423F) which includes Enhanced Joint Tactical Information Distribution System (EJS), Single Channel Ground and Air Radio System (SINCGARS) and HAVE QUICK II anti-jam communication systems. Twenty-four, three per capsule, Ultra High Frequency (UHF) Satellite terminals will be programmed in PE 33605F with installation projected for FY 1987.

6. (U) WORK PERFORMED BY: This is an FY 86 new start program and no contracts have been awarded to date. Warner Robins Air Logistics Center has system management reponsibility for the weapon system. Program management responsibility for RDT&E is yet to be determined.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3170, Airborne Battlefield Command and Control Center (ABCCC) Capsules

A. (U) Project Description: The existing ABCCC capsules were designed and built to meet an immediate tactical warfare requirement in Southeast Asia during the mid-1960s. Even with extensive structural repair and avionic modifications that are necessary to maintain current mission capability and structural integrity, the advanced stage of deterioration of the present capsules leaves serious doubt as to the future capability of ABCCC. This effort will provide new ABCCC capsules with: the required space and group A equipment to accommodate all required equipment scheduled for integration with the capsules, necessary growth needed to meet future command and control requirements, system supportability and maintainability through spares provisioning and a programmed depot maintenance plan.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable

(2) (U) FY 1985 Program: Not Applicable

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The RDT&E funds will be used to develop and test a capsule prototype including a secure communication switching matrix necessary to integrate the existing and planned communications circuits (Parkhill, Vinson, Satellite Communications (SATCOM), SINCGARS, EJS). The program is considered to be low risk and the cost estimates are Category IV planning estimates. Procurement will be competitive The last comprehensive review was June 1984.

(4) (U) Program to Completion: Production capsules will be procured in FY 1987, FY 1988, and FY 1989.

C. (U) Major Milestones

Milestones	Dates
(1) (U) Contract Award (Prototype)	January 1986
(2) (U) Prototype Delivery	April 1987
(3) (U) Integration Testing Complete	July 1987
(4) (U) Contract Award (Capsules 2-8)	August 1987
(5) (U) Initial Operational Capability (Delivery of 2nd Capsule)	August 1988
(6) (U) Final Delivery	August 1990

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27423F
DOD Mission Area: #345 - Tactical Communications

Title: Advanced Communication Systems
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		38,417	86,805	123,785	128,235	245,682	760,488 *
2939	Enhanced JTIDS System (EJS)	31,654	62,087	107,987	125,853	244,549	582,120
2614	SINCGARS-V	2,091	13,006	9,160	1,041	1,133	30,496
2982	HAVE QUICK II	4,672	11,712	6,638	1,341	0	27,063

* Includes $120,809 prior year funds for HAVE QUICK and SEEK TALK projects.

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: [

] The Air Force relies on UHF for primary tactical command and control. Disruption of these communications could degrade the effectiveness of tactical forces[ ] Enhanced JTIDS System (EJS) is a high anti-jam (AJ) voice communications program designed to meet the long-term threat. HAVE QUICK is a near-term program applying demonstrated technology and providing an urgently needed resistance to jammers [ ]while EJS is being developed. The Air Force will participate with the Army to plan for integration of the Single Channel Ground and Airborne Radio System VHF (SINCGARS-V) AJ capability in those weapon systems requiring direct communication with Army, Navy, and NATO forces using SINCGARS-V. This is part of an overall requirement directed by the Joint Chiefs of Staff. HAVE QUICK II is the program to develop HAVE QUICK operational enhancements and performance improvements required to meet the evolving near-term threat until EJS is fielded.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	38,720	86,963	116,576		292,361	672,208
Aircraft Procurement	7,000	11,400	25,300		TBD	TBD
Other Procurement	1,307	7,697	44,660		TBD	TBD

EXPLANATION: (U) Enhanced JTIDS System (EJS) program repriced to reflect recent OSD redirection and rephased to reflect latest platform integration efforts per system manager schedules. The Single Channel Ground and Airborne Radio System (SINCGARS-V) aircraft modification procurement profiles rephased to provide more reasonable production and integration buildup. Aircraft modification initial spares funding for all three projects repriced. HAVE QUICK II aircraft procurement funding rephased to reflect revised plan for increasing transmit power.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
2939 - EJS						
Funds	0	0	0	114,057	2,053,573	2,167,630
Quantities	0	0	0	86	3,454	3,540
2614 SINCGARS-V						
Funds	0	0	0	29,492	116,703	146,195
Quantities	0	0	0	498	2,637	3,135
2982 - HAVE QUICK II*						
Funds	6,000	2,700	11,200	16,151	34,524	70,575
Quantities (Kits)	5,806	2,612	1,502	3,420	7,007	20,347
Other Procurement:						
2939 - EJS						
Funds	0	0	0	52,013	479,555	531,568
Quantities	0	0	0	84	1,111	1,195
2614 - SINCGARS-V						
Funds	0	0	9,790	14,705	8,330	32,825
Quantities	0	0	1,296	1,844	799	3,939
2982 - HAVE QUICK II*						
Funds	1,619	4,903	13,327	14,934	2,548	37,331
Quantities (Kits)	1,003	1,497	1,565	1,577	45	5,687
Operation and Maintenance:						
2939 - EJS	0	0	0	0	283,414	283,414

* Unit prices of kits varies according to improvement(s) being provided in individual kits and according to specific radio system or support equipment being modified or acquired.

5. (U) RELATED ACTIVITIES: The Air Force is participating in the Army Single Channel Ground and Airborne Radio System (SINCGARS) program, PE 63746A, as part of the Joint Chiefs of Staff validated Joint Operational Requirement. Requirement and technical approach are presently being explored with the Navy and Army for the purpose of insuring interoperability. Formal interoperability tasks are part of this program. Techniques which are developed by the Air Force will be coordinated with similar techniques being developed by the other Services.

(U) Enhanced JTIDS System (EJS) requirements and technical approach are being worked in concert with Air Force Joint Tactical Information Distribution System (JTIDS) program (PEs 64754F, 27130F and 72207F), as well as Army and Navy JTIDS programs to insure interoperability. EJS is replacement development program for SEEK TALK, PE 27423F, Project 2277.

6. (U) WORK PERFORMED BY: Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA, has program management responsibility. Hazeltine Corporation, Greenlawn, NY, is the contractor for design of EJS. Magnavox Corporation, Ft Wayne, IN, is the prime contractor for HAVE QUICK, as well as HAVE QUICK II. The Air Force airborne Single Channel Ground and Airborne Radio System-VHF (SINCGARS-V) contractor has not yet been selected; however, the ground SINCGARS-V contractor is ITT, Ft Wayne, IN. The major support organizations include the MITRE Corporation, Bedford, MA (all projects); MIT Lincoln Laboratory, Lexington MA (EJS); Electromagnetic Compatibility Analysis Center (ECAC), Annapolis MD (all projects); the 4950th TW, Wright-Patterson AFB, OH (SINCGARS-V); and the 3246th TW, Eglin AFB FL (HAVE QUICK II, EJS).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2614, SINCGARS-V. The Army has been given development responsibility for a new family of Single Channel Ground and Airborne Radio Systems VHF (SINCGARS-V) radios. The SINCGARS-V program will modernize current field VHF radios and provide anti-jam, secure Electronic Counter-Countermeasures (ECCM). The Air Force is planning to be interoperable with Army SINCGARS-V to accomplish close air support. This project allows Air Force participation in the Army SINCGARS-V program and provides engineering development required to integrate SINCGARS-V into tactical aircraft via a form, fit, function (F^3) replacement for the ARC-186 VHF AM/FM airborne radio. This effort insures Air Force interoperability with Army, Navy and NATO forces using SINCGARS-V. Production funding in the program includes procurement of Air Force developed airborne radios as well as procurement of Army developed ground SINCGARS-V radios.

(U) FY 1984 accomplishments were as follows: participated in Army ground SINCGARS-V program activities; developed the acquisition strategy for the Air Force airborne SINCGARS-V radio; prepared acquisition plan, specification, and request for proposal (RFP) for full scale development (FSD) effort for the Air Force airborne SINCGARS-V capability; and distributed RFP for FSD. FY 1985 Program efforts include initiating FSD of the F^3 SINCGARS-V capable replacement for the ARC-186 and continuing Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) planning. The FY 1986 planned program includes: continuing FSD of the F^3 SINCGARS-V replacement; completing contractor design/fabrication/test of DT&E/IOT&E hardware; beginning DT&E/IOT&E; and initiating procurement of the Army developed ground SINCGARS-V radios.

B. (U) Project: 2982, HAVE QUICK II. HAVE QUICK is a slow frequency hopping Ultra High Frequency (UHF) radio which is providing near-term anti-jam (AJ) voice communications. HAVE QUICK II will assess HAVE QUICK vulnerabilities and develop/implement HAVE QUICK operational enhancements and performance improvements required to meet the threat until the long-term AJ voice program, Enhanced JTIDS System (EJS), is fielded. Improvements include increasing the transmit power, increasing the number of frequencies over which the system can hop, increasing the modulation index, expanding time-dissemination methods, increasing the number of preset frequencies, providing for multiple Word-of-Day entry, and optimizing co-site performance. Efforts will also be devoted to developing the capability to increase the hopping rate and to provide for finer frequency resolution for future system growth. Addition of the HAVE QUICK capability to more air and ground platforms will also be addressed in HAVE QUICK II.

(U) FY 1984 accomplishments were as follows: conducted vulnerability analyses and operational utility improvement studies; completed development and initiated procurement of expanded memory board, which will facilitate several improvements (including more hopping frequencies); and started full scale development (FSD) of other improvements and enhancements. FY 1985 Program efforts include: continuing vulnerability analyses and FSD of improvements/enhancements continuing production of expanded memory board for airborne radios; completing development and initiating production of expanded memory board for ground radios; completing development of new software; and initiating procurement of HAVE QUICK II equipped radios for additional ground and air platforms. The FY 1986 planned program includes: completing FSD of improvements/enhancements; continuing production of expanded memory boards; initiating production of other improvements, i.e., increased transmit power and alternate time-dissemination.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2939, Enhanced JTIDS System (EJS)

A. Project Description: The EJS program is developing a high anti-jam (AJ) voice communication system to protect critical tactical air/air and ground/air voice communications [ ] EJS will employ for training and interoperability purposes the same basic Time Division Multiple Access (TDMA) architecture as developed under the Joint Tactical Information Distribution System (JTIDS) program and will operate in the same portion of the frequency spectrum as JTIDS--L-Band. To achieve its higher level of jam-resistance, EJS will also employ a TDMA-like architecture in an alternative frequency band. [ ] Taking advantage of the TDMA JTIDS technology base will enhance opportunities for interoperability as well as for eventual integration of systems to perform both high AJ voice and data functions. [ ]

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Following completion of a Preliminary Design Review early in the year, significant efforts were devoted toward refining the design to achieve compatibility with Navy JTIDS. Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) test planning commenced. Efforts aimed at eventual integration of the Enhanced JTIDS System (EJS) into the four Full Scale Development (FSD) platforms (OV-10, A-10, GRC-206, and TPS-43E) and the Master Time Distribution System (MTDS) began. Interface control working groups were started for several follow-on platforms, e.g., F-16, F-15 and E-3A. Planning efforts began for potential technology insertion efforts--data applique, Very High Speed Integrated Circuits (VHSIC), miniaturization, low data rate voice, an antenna nulling. A Critical Design Review for the May 1983 OSD directed technical approach was held in June 1984. In July 1984, following a Defense Systems Acquisition Review Council (DSARC) level review, OSD approved an Air Force plan for revision of the EJS technical approach.

(2) (U) FY 1985 Program: A system design review for the July 1984 OSD directed technical approach is planned for March 1985. Fabrication of DT&E/IOT&E airborne and ground equipment will commence for the four FSD platforms and the MTDS. DT&E/IOT&E test planning will continue. Efforts aimed at eventual integration into the FSD platforms will continue. Interface control working groups will continue for previously initiated follow-on platforms and will start for others. Efforts for potential technology insertions will continue. An Independent Cost Analysis (ICA) will be conducted after the March 1985 design review in preparation for an early FY 1986 DSARC Milestone II decision.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: DSARC Milestone II will be held in early FY 1986. FSD activities will continue. Major activities include continuation of contractor design/fabrication/test of airborne and ground platform hardware and the MTDS, planning for DT&E/IOT&E, and platform integration efforts for A-10, OV-10, TPS-43, GRC-206 and F-16, as well as a number of other follow-on platforms, e.g., F-15, F-4G and F-111. Technology insertion efforts will continue, with brassboards to be completed for an adaptive antenna nulling capability. FSD will begin for addition of a data capability.

(4) (U) Program to Completion: Fabrication of DT&E/IOT&E equipment will be completed. Formal contractor qualification testing, Class II modifications on test platforms, and DT&E/IOT&E will be conducted leading to a production decision and Low Rate Initial Production (LRIP) contract award. Developmental integration efforts for all follow-on platforms will be completed. Full production and installation into platforms will begin and continue through the mid-1990's. Major efforts will be devoted to incorporation of new technology devices to improve reliability, maintainability and operational performance. Initial operational capability (IOC) is planned for FY 1989, with full operational capability (FOC) planned for FY 1997.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Tactical Air Force Required Operational Capability 321-75		May 1976
(2)	(U)	Start System Design		January 1978
(3)	(U)	Start Advanced Development Model (ADM)		March 1979
(4)	(U)	Complete ADM		August 1980
(5)	(U)	Start Full Scale Development (FSD)		January 1981
(6)	(U)	Air Force Systems Acquisition Review Council (AFSARC) Level Reviews		June 1982
(7)	(U)	Defense Systems Acquisition Review Council		July 1982
(8)	(U)	Modular Anti-Jam Integrated Communication (MAJIC) Study		August-December 1982
(9)	(U)	AFSARC Level Reviews		December 1982/January 1983
(10)	(U)	DSARC Level Review		March 1983
(11)	(U)	Report to Congress		May 1983
(12)	(U)	Restart FSD		May 1983
(13)	(U)	AFSARC/DSARC Level Reviews		May-June 1984
(14)	(U)	OSD Redirection		July 1984
(15)	(U)	System Design Review		March 1985
(16)	(U)	DSARC Milestone II	*(November 1984)	- October 1985
(17)	(U)	DT&E/IOT&E	*(2Q FY 1987-4Q FY 1987)	- 4Q FY 1987 - 2Q FY 1988
(18)	(U)	Complete FSD	*(4Q FY 1987)	- 2Q FY 1988
(19)	(U)	Production Decision (AFSARC Milestone III)	*(4Q FY 1987)	- 3Q FY 1988
(20)	(U)	Start Low Rate Initial Production	*(4Q FY 1987)	- 3Q FY 1988
(21)	(U)	Initial Operational Capability	*(2Q FY 1987)	- 3Q FY 1989
(22)	(U)	Final Operational Capability		FY 1997

* Date presented in Fiscal Year 1985 Descriptive Summaries.

(U) Explanation of Milestone Changes

All changes in schedule resulted from July 1984 OSD redirection.

Budget Activity: 4, Tactical Programs
Program Element: 27423F, Advanced Communication Systems

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The purpose of the Enhanced JTIDS System (EJS) is to provide a secure, highly jam-resistant, air/air and ground/air voice communication system which will permit the Tactical Air Forces to accomplish their missions in the presence of a severe electronic warfare threat. EJS is a dual band radio that has been designed with a Time Division Multiple Access JTIDS capability in the L-Band. The L-Band is used to achieve the necessary degree of interoperability between EJS and Air Force, Army, Navy and Allied JTIDS equipment. The technical highlights include: frequency hopping, alternate frequency band, increased signal power, and secure voice, which is obtained by using a coded direct-sequence pseudo-random spread spectrum waveform.

(U) Management of the EJS Test Program is the responsibility of the Tactical Communications Test Division of Electronic Systems Division (ESD/TCST). A Test and Evaluation Master Plan (TEMP) is now in review at HQ USAF. The TEMP outlines the proposed testing during DT&E/IOT&E and defines the test objectives. The EJS contractor, Hazeltine Corporation, is responsible for development, fabrication and qualification testing of EJS pre-production models for the A-10 and OV-10 Airborne platforms and the AN/TPS-43 and AN/GRC-206 ground systems. These platforms will form the initial operational capability for the EJS program. The first follow-on platform will be the F-16. A critical design review was held in June 1984, but an Engineering Change Proposal (ECP) to include the capability of the JTIDS interoperability is being reviewed.

(U) DT&E will be conducted in two parts starting in April 1987. The first part will be bench testing which will be performed at Hazeltine, Hauppauge, NY, with support from the Naval Research Laboratory (NRL), 3246th Test Wing, Rome Air Development Center (RADC), Electronic Security Command (ESC) and the contractor, Hazeltine. These tests will include vulnerability assessment, verification of the system's specifications and evaluation of the Flight Test Instrumentation. The stable laboratory conditions will facilitate the collection of data to determine the EJS performance against advanced jamming threats. The second part of DT&E will begin in August 1987 with flight testing at Eglin AFB, Florida. The Flight Test will be conducted by the 3246th Test Wing. Flight test data will be used to substantiate bench-derived data and to investigate system performance under dynamic conditions. NRL will design and fabricate jammers to support testing. Additional support for vulnerability testing will be provided by ESC and RADC.

(U) Other supporting agencies will be used during DT&E. The Tactical Air Command and Tactical Air Warfare Center will provide certain platform assets as well as operations/maintenance personnel. The Air Training Command will monitor the quality of contractor training of Air Force personnel who will maintain and operate EJS equipment during DT&E and IOT&E. The airframe and AN/GRC-206 manufacturer will be under contract through their Aeronautical Systems Division Systems Program Offices or Air Force Logistics Command system managers to integrate EJS into their respective platforms. Hazeltine will integrate and maintain EJS for the AN/TPS-43.

Budget Activity: 4, Tactical Programs
Program Element: 27423F, Advanced Communication Systems

2. (U) Operational Test and Evaluation (OT&E): The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Effectiveness Assessment (OEA) of Advanced Development Model (ADM) equipment from May to August 1981 in conjunction with Rome Air Development Center's (RADC) development test and evaluation (DT&E). The operational objective during this portion of the testing focused on the SEEK TALK communications and jam-resistance capabilities. The AFOTEC report, SEEK TALK Advanced Development Terminal Operational Effectiveness Assessment Test Report (S), is dated February 1982.

(U) SEEK TALK full scale development (FSD) was subsequently redirected during 1982 as a result of a series of Deputy Under Secretary of Defense Communications, Control and Command Intelligence (DUSD/C^3I)-directed studies and reviews and Congressional action. In March 1982, a Tri-Service Anti-jam Architecture Working Group (AJAWG) reported its findings resulting in changes to SEEK TALK (modified SEEK TALK) to address the recommendations of the AJAWG. A June 1982 Air Force Systems Acquisition Review Council (AFSARC)-level review of modified SEEK TALK approved it as the Air Force high anti-jam (AJ) voice communication program.

(U) In September 1982 AFOTEC was tasked to perform an operational evaluation of the modified SEEK TALK technology incorporated in MIT Lincoln Laboratory advanced design model called SEEK COMM. The AFOTEC report, SEEK COMM Operational Evaluation Report (S), is dated March 1983.

(U) The results of the AJ communication architecture study and the AFOTEC evaluation were briefed to Office of the Secretary of the Air Force (OSAF) in January 1983 and resulted in direction supporting HAVE CLEAR (formerly Modified SEEK TALK) as the Air Force-proposed high AJ voice system. A subsequent Defense Systems Acquisition Review Council (DSARC)-level review resulted in direction to proceed with development of the Enhanced JTIDS System (EJS) (formerly HAVE CLEAR).

(U) EJS OT&E, scheduled for November 1987, will be conducted by AFOTEC as an Initial Operational Test and Evaluation (IOT&E) program. IOT&E will share DT&E resources where possible and will include the same EJS equipment used for DT&E. Several IOT&E objectives are similar to the DT&E objectives; test data, where applicable, will be shared. Profiles similar to ones performed during DT&E will be conducted for the purpose of obtaining operational evaluations of EJS performance under differing jammer conditions. During these controlled flights, messages will be exchanged between airborne and surface elements separated from each other and jammers by distances representative of a variety of tactical operational communications links. This will facilitate a prediction of communication effectiveness. The data gathered or data shared from DT&E will be used as a baseline for comparison and correlation with the data obtained during flights of tactical OT&E profiles. Other flight profiles will attempt to duplicate those conditions experienced during typical air-to-air and air-to-ground operational missions. Typical jamming threats will be provided. Mode changes from conventional UHF to EJS will be made during the mission by the test participants/operators in response to jamming encountered. Modeling/simulation will be used to evaluate and complement the flight test results relative to several wartime/theater scenarios.

Budget Activity: 4, Tactical Programs
Program Element: 27423F, Advanced Communication Systems

(U) Initial Operational Test and Evaluation (IOT&E) will evaluate Enhanced JTIDS Systems (EJS) for the tactical airborne set (TAS) (in A-10 and OV-10), ground command and control (C^2) transportable set (GC^2MS) (in TPS-43E radar system), ground C^2 mobile set (GC^2MS) (in AN/GRC-206 communications central), and the master timing distribution subsystem (MTDS) which maintains and distributes system time. Planning for the IOT&E of the above segments is currently in progress.

3. (U) Systems Characteristics. No formal thresholds have been established for EJS; however, key operational and technical performance requirements for EJS are listed below:

Characteristic	Specified Level (Goals)	Proposed Threshold
Jam Resistance (System)	[ ]	[ ]
(U) Conferencing (TAS Only)	3 conferees	3 conferees
(U) Bit Error Rate	10% first signal 15% second signal 20% third signal	15% first signal 20% second signal 20% third signal
(U) Intelligibility	Diagnostic Rhyme Test (DRT) 80% and Diagnostic Acceptable Measure (DAM) 45	DRT 70% and DAM 32
Acquisition/Coverage Probability of Acquisition	[ ]	[ ]
(U) Reliability (Design)		
MTDS	1,465 Hrs	1,315 Hrs
TAS	550 Hrs	500 Hrs
GC^2TS	1,500 Hrs	1,350 Hrs
GC^2MS	1,000 Hrs	900 Hrs
Airborne Command & Control Set (AC^2S)	1,450 Hrs	1,300 Hrs
(U) Reliability (Field)		
MTDS	660 Hrs	600 Hrs
TAS	275 Hrs	250 Hrs
GC^2TS	675 Hrs	615 Hrs
GC^2MS	450 Hrs	410 Hrs
AC^2S	655 Hrs	595 Hrs

Budget Activity: 4, Tactical Programs
Program Element: 27423F, Advanced Communication Systems

Characteristic (Cont'd)	Specified Level (Goals)		Proposed Threshold	
(U) Maintainability using Mean Corrective Time and Maximum Corrective Time (Organizational Level)				
	Mean	Max	Mean	Max
Master Timing Distribution Subsystem (MTDS)	0.3 Hrs	0.5 Hrs	0.35 Hrs	0.6 Hrs
Tactical Airborne Set (TAS)	0.3 Hrs	0.5 Hrs	0.35 Hrs	0.6 Hrs
Ground C^2 Transportable Set (GC^2TS)	0.3 Hrs	0.5 Hrs	0.35 Hrs	0.6 Hrs
Ground C^2 Mobile Set (GC^2MS)	0.3 Hrs	0.5 Hrs	0.35 Hrs	0.6 Hrs
Airborne Command & Control Set (AC^2S)	0.3 Hrs	0.5 Hrs	0.35 Hrs	0.6 Hrs
(U) Availability (Organizational Level)				
MTDS	.999959		.999938	
TAS	.999334		.999167	
GC^2TS	.999600		.999445	
GC^2MS	.999512		.999323	
AC^2S	.999663		.999531	

NOTE: The formula used is $A = \frac{R\ Mission}{R\ Mission + MTTR}$

(U) No test results are available yet for EJS.

4. (U) Current Test and Evaluation (T&E): None

T&E Activity (Past 12 Months). None.

T&E Activity (Next 12 Months). None.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27431F
DOD Mission Area: #324 - TIARA Capabilities Development

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,439	579	2,191	2,778	Continuing	N/A
2387	Intra-Theater Imagery Transmission System (IITS)	867	0	0	0	0	10,422*
2904	Central Command (CENTCOM) Support	572	579	1,452	0	0	2,651
3009	Intra-Theater Intelligence Communications Network (IINCOMNET)	0	0	739	501	501	1,741
3154	Automated Support to Tactical Intelligence (ASTI)	0	0	0	2,277	Continuing	N/A

* (U) Transferred to PE 27435F, Tactical Reconnaissance Imagery and Exploitation, in FY 1985.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces are faced with a critical deficiency in their capability to rapidly and accurately process and disseminate intelligence information from various sources to operational commands and command and control elements. The purpose of this program is to develop and acquire land-based processing, exploitation and dissemination systems for use by tactically deployed general purpose forces.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,439	1,579	2,950		Continuing	N/A
Other Procurement	1,040	4,934	2,200		100	18,524

(U) The decreases in FY 1985 and FY 1986 RDT&E funding is the result of Congressional and Department of Defense cuts in funding for Project 2904, CENTCOM Support (FY 85 -$1,000, FY 86 -$759, and Total Estimated Cost -$3,254). The changes in Other Procurement is the net result of the addition of procurement funds for Project 3009, IINCOMNET (FY 86 +$4,636 and Total Estimated Cost +$18,325) and a Congressional cut (FY 85 -$4,934) in CENTCOM Support.

PE #: 27431F

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Intra-Theater Imagery Transmission System (IITS)*						
Funds	1,040	0	0	0	0	11,290
Quantities	(3)					(42)**
Central Command (CENTCOM) Support						
Funds	0	0	2,200	3,726	0	5,926
Quantities			Not Applicable			
Intra-Theater Intelligence Communications Network (IINCOMNET)						
Funds	0	0	4,636	6,327	7,362	18,325
Quantities			(6)	(9)	(10)	(25)

* (U) Transferred to PE 27435F in FY 1985.
** (U) Includes nine (9) commercial equivalent facsimile transceivers for CENTCOM and Military Airlift Command.

5. RELATED ACTIVITIES: The Army developed AN/TSQ-130(V) was used to satisfy the initial hardware requirements of Project 2904, CENTCOM Support. Program Element 31335F, Air Force Automated Data Processing Support to the General Defense Intelligence Program activities is also directly applicable to this project. Project 3009, IINCOMNET, developed capabilities must be compatible with and integrated into the European segment of the Defense Data Network for common-user service, Program Element 33126F, Long Haul Communications - Defense Communications System, as well as equipment developed under Program Elements 28010F, Joint Tactical Communications Program (TRI-TAC), and 64754F, Joint Tactical Information Distribution System. [ ]components developed in Program Elements 33110F, Defense Satellite Communications System; 33601F, Air Force Satellite Communications System; and 63431F, Advanced Space Communications Systems could be applicable to this project. However,[ ]for the proposed dedicated portion of IINCOMNET. The Air Force established the Intelligence Communications Working Group, with membership from major air command intelligence and communications staffs and participation from the National Security Agency, the Defense Intelligence Agency's Intelligence Communitions Architecture Project Office (INCA PO), and the Defense Communications Agency, to ensure fully coordinated communications planning. Preliminary demonstration of the feasibility of the proposed dedicated portion of IINCOMNET, Project ENDRUN, is being conducted under Program Element 35885G, with financial support from the INCA PO, which supports IINCOMNET objectives. Follow-on procurement for ENDRUN is in Program Element 31339F, Intelligence Communications and Defense Special Security System.

6. (U) WORK PERFORMED BY: Air Force management is provided by Rome Air Development Center, Griffiss AFB, NY. Tobyhanna Army Depot, Tobyhanna, PA is integrating contractor for the communications shelter developed under Project 2904,

CENTCOM Support. Planning Research Corporation, McLean, VA and RCA, Burlington, MA are responsible for software and hardware support, respectively, for the interim Automated Data Processing (ADP) system.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2904 - Central Command (CENTCOM) Support. This project provides for the acquisition of a Deployable Intelligence Data Handling System (DIDHS) for the US Central Command (USCENTCOM). This deployable system is needed to process and correlate incoming intelligence message traffic and present battlefield information in a manner suitable for command decision making. In FY 1984, continued contractor hardware and software maintenance and tailoring of software and fabrication of the second segment of the prototype system. This segment, in an S-280 shelter, provides the necessary communications capabilities. In FY 1985, upon delivery of the communications segment in February 1985, will begin operational testing and evaluation of the complete system to define requirements for a deployable ADP van to replace the interim prototype AN/TSQ-130(V)-based capability, which has been used operationally since October 1982. In FY 1986 plan to complete development of, begin procurement of components for, and integrate these components into, the deployable ADP van. This van when combined with the previously delivered communications van will meet the long-term DIDHS requirements of the deployed Commander-in-Chief USCENTCOM. The program, prior to its completion in FY 1987, will include the transfer, conversion and tailoring of DOD Intelligence Information System (DODIIS)-compatible intelligence community software to meet the USCENTCOM requirements and the establishment of a software support facility to support Readiness Command/CENTCOM (in-garrison and deployed).

B. Project: 3009 - Intra-Theater Intelligence Communications Network (IINCOMNET). This is an FY 1986 new start project. [ ] The Air Force Intelligence Communications Working Group has identified improvements in terrestrial intelligence communications as its number one priority. This project funds the development and implementation of a high capacity multi-node data distribution network through a combination of common-user packet switching capability and [ ] The packet switching capability will be compatible with and integrated into the European segment of the Defense Data Network. [ ] Initial efforts will concentrate on procuring packet switches and Defense Communications System (DCS)/leased communications links. Engineering efforts are required to integrate the packet switches and terminal access controllers at the initial nodes, refine protocols for the system, determine network services and develop interfaces to other communications systems (e.g., packet radios and NATO networks). Prior to project completion, the packet-switched, DCS/leased communications system will be expanded to cover the full network. An alternate, but primary, dedicated communication path will be established using [ ]

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27435F (27431F) (64751F)
DOD Mission Area: #327 - TIARA for Tactical Air Warfare

Title: Tactical Reconnaissance Imagery and Exploitation
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	1,156	7,691	745	Continuing	N/A
2387	Intra-Theater Imagery Transmission System (IITS)	0*	1,056	963	745	307	10,379*
3068	Advanced Deployable Digital Imagery Support System (ADDISS)	0	100	6,728	0	0	6,828

*IITS funded in Program Element 64751F, IITS, through FY 1982 (total R&D costs through FY 1982 was $5,376); funded in Program Element 27431F, Tactical Air Intelligence System Activities, in FY 1983 and FY 1984 (total R&D during this period estimated at $1,932).

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces are faced with a critical deficiency in their capability to rapidly receive, process, exploit, and disseminate reconnaissance imagery from various collection systems. The purpose of this program is to develop and acquire land-based imagery processing, exploitation, and dissemination systems for use by tactically deployed general purpose forces.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	Additional to Completion	Total Estimated Cost
RDT&E	0	1,156	2,460	Continuing	N/A
Other Procurement	0	0	15,536	25,550	41,086

(U) The increase in FY 1986 RDT&E request is the result of the additional funding requirements associated with procurement of an Army-developed Tactical Imagery Exploitation System (TACIES) (FY 86 +$5,252) under Project 3068, ADDISS. The increase in Other Procurement is the net result of the addition of procurement funds for TACIES (FY 86 and Total Estimated Cost +$27,871) and a decrease in procurement funds required for IITS (FY 86 -$5,947 and Total Estimated Cost -$4,056).

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Intra-Theater Imagery Transmission System (IITS)*						
Funds	0	0	9,589	16,383	11,058	37,030
Quantities			(41)	(67)	(22)	(130)
Advanced Deployable Digital Imagery Support System (ADDISS)						
Funds	0	0	27,871	0	0	27,871
Quantities			(1)			(1)

*Transferred from Program Element 27431F in FY 1985 (Total procurement through FY 1984 - $11,290 (33 plus nine (9) commercial equivalent facsimile transceivers for US Central Command and Military Airlift Command).

5. (U) RELATED ACTIVITIES: Program Element 64751F, Project 2387, IITS, transferred to Program Element 27431F, Tactical Air Intelligence System Activities, in FY 1983 and transferred to this Program Element in FY 1985. Exploratory and advanced development activities related to this program are conducted under Program Elements 62702F, Command, Control and Communications and 63789F, Command, Control, and Communications Advanced Development. The Tactical Digital Facsimile (TDF) transceiver, which is to be used in the IITS was initially developed for the Joint Tactical Communications (TRI-TAC) program by the Navy under Program Element 28010N, Project XO 723-CC. Responsibility for procurement of production TDF transceivers was transferred from the Navy to the Air Force in FY 1984. Front end program costs (production startup, depot establishment, logistics) are now funded in Program Element 28010F, Joint Tactical Communications program. Developments within Program Element 63239F, Advanced Tactical Air Reconnaissance System, will be closely monitored to ensure that the requirements for imagery exploitation equipment are satisfied. Technology and/or equipment developed within Program Elements 64756F, Side Looking Airborne Radar; 64750F, Intelligence Equipment; and 31305F, Intelligence Production Activities may also apply. Coordination with activities and developments of the Softcopy Exploitation System Joint Program Office is required. Program Elements 35159G, Defense Reconnaissance Support Activity and 27247F, Air Force TENCAP also are related.

6. (U) WORK PERFORMED BY: Air Force management for the IITS program is provided by Electronic Systems Division, Hanscom AFB, MA. Tobyhanna Army Depot, Tobyhanna, PA is acting as the integrating contractor for the US Central

Command (USCENTCOM) and Military Airlift Command (MAC) terminals and MITRE Corporation, Bedford, MA provides technical support to the program office. Litton Amecon Corporation, College Park, MD and Melville, Long Island, NY developed the prototype Tactical Digital Facsimile (TDF) transceiver, is producing the FASTFAX 2000 for current efforts under the Intra-Theater Imagery Transmission (IITS) program and will produce the production TDF for the IITS terminals.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2387 - Intra-Theater Imagery Transmission System (IITS). The IITS project will develop and acquire facsimile transceiver terminals to provide timely, secure transmission of high priority reconnaissance imagery over Defense Communications System and tactical communications to command and control centers, mission planners and strike crews. Use of these transceivers will greatly improve the delivery of time sensitive target imagery to the strike crews and will relieve from courier duty, aircraft, crews and fuel currently used to distribute priority imagery. Timely imagery support will enhance ordnance and tactics selection, as well as target orientation for the strike crews. Upon completion of the Initial Operational Test and Evaluation (IOT&E), in FY 1982, the prototype equipment was provided to United States Air Forces in Europe (USAFE) to provide them an Interim Operational Capability. USAFE will continue to operate the system at seven locations in Germany and the United Kingdom (Ramstein Air Base, GE; Spangdahlem Air Base, GE; Zweibrucken Air Base, GE; NATO Support Center, Kalkar, GE; Shierstein, GE; Royal Air Force Base Lakenheath, UK; and Royal Air Force Base Alconbury, UK), using existing AUTOVON circuits, until these prototype terminals can be replaced with production units. As a result of this hardware's proven capability, one other terminal, originally located at Ramstein Air Base during the IOT&E, was loaned to the Joint Chiefs of Staff to support the Strategic Arms Reduction Talks in Geneva, Switzerland. The acquisition of nine commercial equivalent facsimile transceivers (FASTFAX 2000) and fabrication into terminals for delivery to USCENTCOM and MAC, to meet immediate operational requirements, began in FY 1983. Six of the first transceivers delivered were diverted to meet a more urgent Joint Chiefs of Staff requirement. During FY 1984, acquisition of FASTFAX 2000s and fabrication of the CENTCOM and MAC terminals continued and operator and maintenance training, site installation engineering and terminal TEMPEST testing was completed. Procurement of the TDF transceivers began. In FY 1985, the acquisition and installation of CENTCOM and MAC terminals will be completed and all transit cases for these terminals will be delivered to CENTCOM. Procurement of TDFs will continue, production terminal and transit case basic specifications and a statement of work for the production terminal integration will be completed. Will also resolve theater unique IITS installation configuration problems as they relate to the multiple communications media that must be accommodated. In FY 1986, will continue procurement of TDFs and begin detail terminal integration design. R&D efforts on specifications for a preplanned product improvement for the basic IITS to increase the capacity and flexibility of the terminal and the quality of retransmitted images will begin. This improvement will also reduce the burden on communications. Terminal integration and initial installations will begin in FY 1987 and be continued through FY 1990. Improvements to the system will also be incorporated before the program is completed.

B. Project: 3068 - Advanced Deployable Digital Imagery Support System (ADDISS). Major commands and selected tactical units within the Air Force have a requirement for rapid receipt, processing and exploitation of digital imagery from current and planned[ ]sources. Such a capability would give the tactical operational commander access to the best imagery intelligence available for his specific area of interest during peace, crisis and war. At present, the Air Force deployable forces have no satisfactory method to process, display, exploit, store, and retrieve [ ]digital imagery[

] This project is to define an advanced, deployable imagery support system by addressing detailed requirements definition, stateof-the-art and future technology applications, engineering design concepts, generic and specific concepts of operations and collection simulation analysis. Experience and further definition of requirements will be gained through acquisition and operation of an Army-developed Tactical Imagery Exploitation System (TACIES). The program, started in FY 1985, begins with the definition and consolidation of all major command requirements and the assessment of the feasibility of developing a capability to handle such digital processing and exploitation. In addition to the Army's TACIES, it will also examine the direct applicability of other existing programs such as the DOD Image Data Exploitation (IDEX) II system and the Tactical Reconnaissance Exploitation Demonstration System (TREDS)/TR-1 Ground Station (TRIGS). In FY 1986, procurement of Army TACIES begins. Engineering development of additional capabilities unique to Air Force requirements and communications interfaces unique to Pacific Air Forces will be accomplished to enable[ ] Additionally, Air Force unique requirements for ADDISS will be identified and inserted in any follow-on Army TACIES program. The PACAF TACIES will be installed[ ]

8. (U) PROJECTS OVER $1C MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27595F
DOD Mission Area: #360 - Support and Base Communications

Title: Base Comm - Tactical Air Forces
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		476	985	899	884	Continuing	N/A
2941	Assured Logistics Communications	476	985	899	884	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provide assured wartime communications for direct combat logistics support.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	476	985	982		Continuing	N/A
Other Procurement	198	0	1,950		8,320	10,468

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement	198	693	1,920	2,383	8,828	14,022

5. (U) RELATED ACTIVITIES: Logistics Information Management Support System (LIMSS) (Project 2983) is funded in PE 64740F, Computer Resources Management Technology.

6. (U) WORK PERFORMED BY: Air Force Systems Command (AFSC) manages this project through the Electronic Systems Division (ESD), Hanscom AFB, MA. Work is being performed under contract with Dynamics Research Corporation, Wilmington, MA.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2941, Assured Logistics Communications

Program Element: #27595F
DOD Mission Area: #360 - Support and Base Communications

Title: Base Comm - Tactical Air Forces
Budget Activity: #4 - Tactical Programs

A. (U) Project Description: Funds baseline and development effort to provide assured communications for United States Air Forces Europe/Pacific Air Forces (USAFE/PACAF) logistics activities by providing access to alternate paths for critical wartime communications. Dollars provide for development of base networking/Automatic Data Processing (ADP) interfaces, user terminals and access lines to alternate networks. Alternate networks identified for USAFE are Movements Information Network (MINET) and Public Data Networks (PDN). Both networks selected as a result of Office, Secretary of Defense/Joint Chiefs of Staff (OSD/JCS) funded research and implementation efforts and were recommended in Defense Audit Services (DAS) report on Wartime Logistics Communications.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Developed definition of program strategy and near term work plan. Defining requirements and identifying technology to address those needs. A contract was negotiating with Dynamics Research Corporation, Wilmington, MA.

(2) (U) FY 1985 Program: Conceptual phase. Complete definition of the requirement. Define the technology used. Define the most logical approach. Provides for a project to improve information flow in PACAF.

(3) (U) FY 1986 Planned Program and Basis for the FY 1986 RDT&E Request: The effort will proceed with selected approaches. Provide advanced development model and full development model. Develop prototype projects. Selected equipment upgrades will be acquired to interface new programs with common user systems.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:*

Milestones	Dates
(1) (U) Program Management Plan	1st Qtr/FY 1985
(2) (U) Architectural Alternatives	2nd Qtr/FY 1985
(3) (U) Conceptual Phase Complete	1st Qtr/FY 1986
(4) (U) Full Scale Development & Testing	FY 1986/87

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

* - Milestones revised from those submitted for FY85 to more appropriately describe the structure of the program.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #28010F
DOD Mission Area: #345 Tactical Communications

Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	20,573	10,000	4,947	4,338	Continuing	N/A
2260	Communications Nodal Control Element	10,000	5,000	2,800	975	Continuing	N/A
2266	Digital Troposcatter Terminal	2,700	1,000	700	875	Continuing	N/A
2267	Test	3,700	1,500	0	0	N/A	N/A
2270	Support and Integration	4,173	2,500	1,447	2,488	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The TRI-TAC program develops digital communications equipment for tactical operations. The Air Force needs to replace the aging and outdated equipment now in use with a secure, anti-jam communications network. Equipment developments include transmission and switching equipment, system control facilities, local distribution equipment, terminal devices, and interface equipment. The Air Force part of this joint development includes the Digital Troposcatter Terminal (TROPO) and Communications Nodal Control Element (CNCE).

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	Additional to Completion	Total Estimated Cost
RDT&E	20,587	11,467	6,614	Continuing	N/A
Other Procurement (Including Spares)	141,627	157,130	237,685	Continuing	N/A

Congressional cut in FY 1985 RDT&E will delay development of depot level support equipment. Funding in FY 1986 and subsequent years for project 2267 Test has been transferred to the new Joint Tactical Command, Control, and Communications Agency. The FY 1985 Other Procurement reflects congressional denial of funds for the Unit Level Switch. In FY 1986, procurement of several equipments were deferred in whole or part due to funding priorities within the Air Force. In all years, the other procurement funding has been adjusted to include only initial spares for consistency with the Selected Acquisition Report.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement* (including initial spares)	113,131	118,257	176,139	314,530	Continuing	N/A

*These funds are for the procurement of numerous items of TRI-TAC equipment and are not identified by project - applies to entire PE.

5. (U) RELATED ACTIVITIES: Program Element 28010 is conducted by all Services under the overall direction of the Office of Assistant Secretary of Defense, Command, Control, Communications and Intelligence, and the guidance of the Joint Tactical C^3 Agency, Ft Monmouth, NJ. Developments and interfaces of tactical communications systems are coordinated within this program element. The objective is to ensure sufficient coordination to prevent duplication of effort and to permit standardization of interfaces. The program also interfaces with the Tactical Air Control System Improvement Program, PE 27412F, through a bilateral working group and the Fiber Optics Development Program, PE 63726F, through the Air Force Fiber Optics Working Group.

6. (U) WORK PERFORMED BY: The Air Force Systems Command manages the Air Force portion of this program through the Electronic Systems Division, Hanscom AFB, MA, and Rome Air Development Center, Griffiss AFB, NY. Current contractors include: Martin-Marietta Corporation, Orlando, FL, Communications Nodal Control Element (CNCE); Raytheon, Sudbury, MA, Troposcatter Radio (TROPO); Analytical Systems Engineering Corporation, Burlington, MA, System Engineering Support; and MITRE Corporation, Bedford, MA, System Engineering Support.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2260, Communications Nodal Control Element. The CNCE is the hub of the Tactical Communications System controlling the TRI-TAC system for maximum efficiency as well as providing an interface point for allied and commercial systems. This equipment is in production with initial deliveries in FY 1986. In FY 1984, the major portion of the correction of Operational Test and Evaluation (OT&E) software problems was accomplished. Work started on the design of depot level Peculiar Support Equipment (PSE). The software corrections will be completed in FY 1985 and work will continue on PSE. Design of peripheral equipment for training will begin. FY 1986 funding will be used to continue the design of depot and training support equipment. These are required to support production units being fielded at the end of CY 1986. Interim contractor support will be required if these are not available.

B. (U) Project: 2266, Digital Troposcatter Terminal. This system will provide a digital troposcatter radio for long-range, wideband tactical communications in support of Tactical Air Control System and deployment of Tactical Air Forces. In 1984, study of Electromagnetic Counter Counter Measures (ECCM) approaches included successful field testing of candidate techniques. Path prediction testing over water was performed over the English Channel in conjunction with the Digital European Backbone upgrade to the Defense Communication System. Design of depot PSE was started. First production units were delivered in October 1984. Path prediction efforts will be completed in FY 1985 and limited ECCM capability will be provided with an interim design change. Technical definition of a full ECCM capability will continue as will PSE design. In FY 1986, technical definition of full ECCM will be completed and source selection efforts will begin for the FY 1987 contract. Design of PSE will continue.

C. (U) Project: 2270, Support and Integration. This project provides for the integrated planning and system manuals required to incorporate the new digital systems into the current inventory as the various TRI-TAC equipment deliveries occur over several years. Also incuded are Air Force peculiar support equipment, manuals, and Engineering Change Proposals (ECPs) for equipment developed by other services; interface equipment; Air Force IOT&E, and basic program office support. In 1984, development of a Complex Interface Unit (CIU) for the Advanced Narrowband Digital Voice Terminal (ANDVT) was continued and work began on Air Force peculiar requirements for the AN/TCC-42. Fielding of the AN/TCC-39 was supported. The CIU and AN/TTC-42 ECP efforts will be completed in FY 1985. Fielding of AN/TRC-170 Tropo Radios will be supported. Support will continue in FY 1986 for fielding AN/TRC-170 Tropo Radios and begin for the Communications Nodal Control Element (CNCE) - principal equipment required for operation as a system.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

Budget Activity: 4, Tactical Programs
Program Element: 28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Joint Tactical Communications (TRI-TAC) program is a joint program with each service and the National Security Agency responsible for the development of assigned equipment, including DT&E. The Air Force has been assigned the Communications Nodal Control Element (CNCE), Digital Troposcatter Radio (AN/TRC-170), Digital Nonsecure Voice Terminal (DNVT), and Short-Range Wideband Radio (SRWBR). (The Tactical Digital Facsimile (TDF) was developed by the Navy and transferred to the Air Force for production.) All developmental testing of these equipments has been completed. Individual test plans including interface parameters were coordinated with the TRI-TAC office. Initial developmental testing is conducted in-plant by the developing contractor. DT&E includes hardware integration testing, communications security, integration, reliability and maintainability, and acceptance testing of peripheral equipment. The contractor for the CNCE is Martin-Marietta, Orlando, FL. The Raytheon Co., Sudbury, MA is the prime contractor for the AN/TRC-170. The contractor for the DNVT is General Atronics Corp, Philadelphia, PA. These equipments are presently in production. A commercial microwave radio will be procured for Air Force SRWBR requirements and development will not be required.

2. (U) Operational Test and Evaluation (OT&E): TRI-TAC test and evaluation is being conducted as a multiservice, combined DT&E/IOT&E program. The independent test agency of the lead acquisition service for each system has overall responsibility for OT&E of that system. Full-scale development models of each TRI-TAC equipment are operated and maintained by Army, Navy, Marine Corps, and Air Force personnel during IOT&E. These personnel are selected from the using commands and agencies on the basis of specialty codes expected to be used during operational equipment deployment. Testing is conducted primarily at Ft. Huachuca, Arizona, with additional interface testing planned at the Navy facilities in San Diego, California.

(U) The Air Force Operational Test and Evaluation Center (AFOTEC) has OT&E responsibility for the CNCE, DNVT, and AN/TRC-170.

(U) The CNCE IOT&E began in June 1980 and ended 16 October 1981. AFOTEC recommended that funding to fix all mission essential deficiencies be established prior to the production decision, an aggressive reliability and maintainability program be established, and an FOT&E be conducted on the production CNCE to verify the corrections. Most of these actions are in process. FOT&E planning is underway. The AFOTEC Air Force Evaluation Report for the TRI-TAC AN/TSQ-111 CNCE was dated January 1982.

(U) The IOT&E of the AN/TRC-170 was completed in October 1980, and the AFOTEC TRI-TAC AN/TRC-170( )(V) Tropo IOT&E Report was dated December 1980. AFOTEC recommended a favorable production decision provided that deficiencies are corrected and that engineering corrections to improve reliability and antenna mobility are incorporated into the development models and retested before delivery of production equipment to the field. A quick reaction capability antenna has been successfully tested and reliability improvements are installed in development models for test.

Budget Activity: 4, Tactical Programs
Program Element: 28010F, Joint Tactical Communications (TRI-TAC)

(U) The Digital Nonsecure Voice Terminal (DNVT) IOT&E was completed in January 1982. The AFOTEC reports Air Force Evaluation Report for the TRI-TAC TA-954(V)1/TT and TA-984(V)1/TT GAC DNVT and Air Force Evaluation Report for the TRI-TAC TA-954(V)2/TT and TA-984(V)2/TT ECI DNVT are dated May 1982. Recommended improvements in reliability and correction of performance problems are being tested using production units during Production Acceptance Test and Evaluation and at the Joint Test Facility, Ft. Huachuca.

(U) The US Army Operational Test and Evaluation Agency (USAOTEA) has OT&E responsibility for the AN/TYC-39 message switch, AN/TTC-39 circuit switch, Digital Group Multiplexer (DGM), Mobile Record Traffic Terminal (MRTT), and the Net Radio Interface (NRI). These TRI-TAC equipment items are programmed to enter the Air Force inventory. There was no USAF participation in the basic NRI IOT&E; however, there will for the secure digital NRI unit.

(U) Four AN/TYC-39 message switches were tested from 15 February 1979 through 15 June 1979. Although deficiencies existed, the AN/TYC-39 demonstrated the potential to provide a significant improvement in message throughput, decreased operator workload, and message traffic accounting. Defense Systems Acquisition Review Council (DSARC) III was in March 1980 and recommended production of the AN/TYC-39. The AFOTEC report TRI-TAC Automatic Store and Forward Message Switch (AN/TYC-39) IOT&E Air Force Evaluation Report was dated October 1979. An FOT&E was conducted by the Army at Ft. Hood, Texas, in April 1983. Air Force switch operators participated in the test. Switch performance was rated satisfactory. Need for improvements was identified and changes are being implemented in operator, maintainer, and system's training.

(U) Four AN/TTC-39 circuit switches were tested from 13 November 1979 to 20 May 1980. Although deficiencies were discovered, the AN/TTC-39 performed well enough for the July 1980 DSARC III to recommend production. Because the software tested in the AN/TTC-39 was not the software to be procured, there was additional testing from November 1980 to February 1982 to test the operational software. AFOTEC managed an exercise deployment of the AN/TTC-39 during this period to evaluate performance in an operational environment after some modifications had been incorporated into the software and hardware. However, few of the fixes made to the system were found to have been effective, and no improvement in the system reliability was noted. Although performance improved, system reliability was still deficient. The results are documented in the USAOTEA Report AN/TTC-39 Circuit Switch Follow-on Evaluation (FOE) Test Report, dated March 84. The AFOTEC report TRI-TAC Automatic Telephone Central Office Circuit Switch (AN/TTC-39) IOT&E Air Force Evaluation Report was dated August 1980. The AFOTEC report Air Force Evaluation Report for TRI-TAC Automatic Telephone Central Office Circuit Switch (AN/TTC-39) Exercise Deployment was dated June 1982.

(U) Digital Group Multiplex (DGM) equipment is currently being tested as integral parts of other individual TRI-TAC equipments. In addition, a separate DGM IOT&E was conducted by the United States Army Operational Test and Evaluation Agency (USAOTEA) and the US Marine Corps from September through November 1980. Those elements of the DGM family planned for Air Force use showed a potential to be operationally effective; however, their operational suitability was deficient. The production decision was in July 1981. Modifications to correct the deficiencies were successfully tested, in-plant, by the Army this year on the first production units. The AFOTEC TRI-TAC Digital Group Multiplex (DGM) IOT&E Air Force Evaluation Report was dated May 1981.

Budget Activity: 4, Tactical Programs
Program Element: 28010, Joint Tactical Communications (TRI-TAC)

(U) The Modular Record Traffic Terminal (MRTT) program consists of the AN/UGS-137 Single Subscriber Terminal (SST) and the Modular Tactical Communications Center (MTCC). The SST IOT&E is scheduled to begin in April 1985. A schedule for the MTCC program has not been finalized.

(U) The Marine Corps Operational Test and Evaluation Agency (MCOTEA) has OT&E responsibility for the unit level switch (ULS) program. The ULS comprises three equipment items: an AN/TTC-42 unit level circuit switch (ULCS), an SB-3865 switchboard, and an AN/GYC-7 unit level message switch (ULMS). There are no Air Force plans to procure the AN/GYC-7. The combined IOT&E on the AN/TTC-42 and SB-3865 was conducted from 16 January 1984 to 14 May 1984. The IOT&E test team was a multi-service team including AFOTEC tactical communications test team personnel. During the IOT&E, the AN/TTC-42 and SB-3865 were employed in a variety of tactical communications networks representative of the intended operational environment. The operational effectiveness of the AN/TTC-42 was deficient primarily because of interoperability problems. Many of these were TRI-TAC system level problems with the AN/TTC-39 circuit switch which must be worked between the two programs. Operational effectiveness of the SB-3865 was satisfactory. The operational suitability of both the AN/TTC-42 and SB-3865 was deficient in reliability, availability, and maintainability (RAM). Demonstrations of contractor fixes to major interoperability and RAM deficiencies are planned for January through February 1985. The AFOTEC Report is AN/TTC-42 and SB-3865 Unit Level Circuit Switch (ULCS) Final Report, dated August 1984.

(U) The Navy operational testing organization, COMOPTEVFOR, has OT&E responsibility for the Tactical Digital Facsimile (TDF) and the Advanced Narrowband Digital Voice Terminal (ANDVT).

(U) The TDF IOT&E was conducted from April 1981 through July 1981 with AFOTEC participating in the testing at Ft. Huachuca. Test results indicated that operational performance was satisfactory, but reliability, maintainability, and availability require improvement. Phase II of the IOT&E was conducted from 15 February 1982 to 2 April 1982 to evaluate fixes to mission-essential deficiencies identified earlier. AFOTEC recommended procurement provided that the remaining corrections are incorporated and that additional testing to verify these corrections is conducted prior to fielding the TDF. These actions are being taken. Planning for OT&E is underway. The AFOTEC IOT&E reports are <u>Air Force Evaluation Report for Tactical Digital Facsimile AN/UXC-4( )(V) IOT&E</u> dated October 1981 and <u>Abbreviated Air Force Evaluation Report for TRI-TAC AN/UXC-4( )(V) IOT&E Phase II</u> dated June 1982. This program has been transferred to the Air Force for production.

The IOT&E of the ANDVT was conducted between 3 October 1983 and 30 March 1984. Operational effectiveness of the ANDVT in its primary use as a secure voice communications device for satellite and wireline systems was satisfactory. Operational effectiveness with high-frequency (HF) systems in a benign environment was also satisfactory. However, ANDVT Also, it was found that the ANDVT was Data message accuracy did not meet the criteria for HF, satellite, or wireline media and, therefore, use as a data transmission system was deficient. Operational suitability was satisfactory. The contractor has demonstrated an improvement in the terminal's operation in an ECM environment, and improvements will be included in the production units. The results of the Air Force evaluation are contained in the <u>Air Force Advanced Narrowband Digital Voice Terminal Initial Operational Test and Evaluation Final Report</u>, July 1984.

Budget Activity: 4, Tactical Programs
Program Element: 28010, Joint Tactical Communications (TRI-TAC)

(U) The National Security Agency has test and evaluation responsibility for all communications security (COMSEC) items being procured in the TRI-TAC program. COMSEC equipment items are being tested in conjunction with intraoperability, interoperability, and communications security tests conducted during IOT&E of other TRI-TAC equipments.

3. (U) System Characteristics:

Communications Nodal Control Element:

CHARACTERISTIC	OBJECTIVE/THRESHOLD	DEMONSTRATED
Digital Groups		
Type I	48	48
Type II	480	480
Analog Channels		
Type I	24	24
Type II	144	144
Transmission Rates		
Analog	4-108 HZ	4-108 HZ
Digital	0-19.2 MB/s	0-19.2 MB/s

Troposcatter Radio

CHARACTERISTIC	OBJECTIVE/THRESHOLD	DEMONSTRATED
Power		
Type 1	10 Kilowatts	10 Kilowatts
Type 2	1.5 Kilowatts	1.5 Kilowatts
Type 3	.66 Kilowatts	.66 Kilowatts
Range		
Type 1	200	200
Type 2	150	150
Type 3	100	100
Capacity (Digital Channels)	60	60

Digital Nonsecure Voice Terminal

CHARACTERISTIC	OBJECTIVE/THRESHOLD	DEMONSTRATED
Range	4-8 KM	4-6 KM
Weight	6 Lbs	6 Lbs
Rate	16/32 KB/s	16/32 KB/s

Budget Activity: 4. Tactical Programs
Program Element: 28010F, Joint Tactical Communications (TRI-TAC)

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months):

EVENT	Planned Activity	Actual Date	Remarks
Unit Level Circuit Switch (ULCS) IOT&E start	January 1984	January 1984	
Advanced Narrowband Digitial Voice Terminal IOT&E completion	March 1984	March 1984	
ULCS IOT&E completion	May 1984	May 1984	

T&E Activity (Next 12 Months):

EVENT	Planned Date
Single Subscriber Terminal (SST) IOT&E start	April 1985
SST IOT&E completion	May 1985

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 33605F
DOD Mission Area: #333 - Strategic Communications

Title: Satellite Communications (SATCOM) Terminals
Budget Activity: 4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	2,860	7,569	2,937	Continuing	N/A
3163	MAC UHF SATCOM Terminals (MUST)	0	2,460	4,882	2,937	0	10,397
3164	Ground Mobile Force Terminals	0	400	2,687	0	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Military Airlift Command (MAC) Ultra-High Frequency (UHF) Satellite Terminal (MUST) program (Project 3163) will develop a small satellite communications terminal which operates in either the airborne or ground mode to support MAC communications requirements. These terminals will permit more effective use of limited airlift resources by providing MAC with a flexible, reliable, and secure worldwide Command and Control (C^2) system. The Ground Mobile Forces Terminal (GMFT) program (Project 3164), is a joint service (Army, Air Force, & Marine Corps) program to develop a family of tactical satellite communications terminals to support tactical ground forces. The Air Force requirements in the GMFT program include development of a small (man-transportable and para-droppable) tactical satellite terminal to meet requirements of MAC Combat Control Teams, Special Operations Forces and elements of the Tactical Air Control System.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	0	2,860	2,735		Continuing	N/A
OTHER PROCUREMENT	0	0	4,000		Continuing	N/A
AIRCRAFT PROCUREMENT	0	3,500	0			

RDT&E: (U) FY 1986 RDT&E funds for MAC UHF SATCOM Terminals were increased to develop terminal equipment and the Demand Assigned Multiple Access capability to make effective use of existing UHF satellite capacity. As a result, MAC UHF SATCOM Terminal procurement was rescheduled from FY 1986 to FY 1988.

OTHER PROCUREMENT: (U) FY 1986 procurement funding was delayed to FY 1988 so that production would not begin before development is complete.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	0	3500 *	0	0	0	17,649 *
Quantities	0	110	0	0		

* After FY 1985, 3010 funds for aircraft procurements are programmed in PE 41840F as part of the Military Airlift Command (MAC) C^2 Upgrade program.

5. (U) RELATED ACTIVITIES: Prior to FY 1985, funding for MAC C^2 Upgrades was programmed in PE 41840F (MAC C^2 Upgrades). Beginning in FY 1985, the satellite terminal development and acquisition portion of the MAC C^2 upgrades is transferred to PE 33605F. Other portions of the MAC C^2 Upgrade program will remain in PE 41840F.

6. (U) WORK PERFORMED BY: Air Force System Command's Electronic Systems Division (ESD), Bedford, MA will provide overall program management. Specific contractors have not yet been identified.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3163 , MAC UHF SATCOM. The Military Airlift Command requires the capability to efficiently project airlift to any worldwide location while maintaining near real-time control of those assets. In addition, MAC is often the first U.S. presence in crisis, contingency locations and must provide its own communication systems. Project 3163 develops a transportable ultra-high frequency (UHF) satellite communications terminal that can be employed in both an airborne and ground mode of operation. This satellite terminal will be based upon existing UHF satellite terminal design with modifications for either airborne or ground operation with secure voice and data. The design will incorporate a Demand Assigned Multiple Access (DAMA) technique to make efficient use of existing UHF satellite communications channels. The program will also install UHF satellite antennas on MAC aircraft to allow operation of satellite communications terminals while airborne. The flexible multi-mission design concept will allow the terminals to be quickly moved between aircraft or removed from the aircraft for ground operations as required to support mission requirements. The FY 1984 program was funded in PE 41840F (MAC C^2 Upgrades). The FY 1984 program developed a system acquisition strategy, evaluated a DAMA technology for the MAC UHF SATCOM Terminals (MUST) system, and prepared a draft specification for the MUST terminals. The FY 1985 program will finalize system specifications, conduct an In Progress Review (IPR) to approve the specifications and award a full scale development contract for the MUST terminals including the DAMA capability. The FY 1986 program will continue full scale development including fabrication and development

testing of prototype MUST terminals with DAMA capability. FY 1987 RDT&E will include Initial Operational Test and Evaluation (IOT&E) of the MUST system and an IPR for full scale production. The FY 1987 completes RDT&E development of the MUST system. Equipment procurement will be initiated in FY 1988.

B. (U) Project: 3164, Ground Mobile Forces Terminals (GMFT). The Air Force requires a small, lightweight communications terminal to provide survivable secure voice and data for highly mobile combat teams such as Forward Air Controllers, Special Operations Forces and MAC Combat Control Teams. Project 3164 develops a lightweight extremely high frequency (EHF) satellite ground terminal which meets these mobility requirements and can be transported by a team of men or be para-dropped with the team. This EHF terminal will use technology developed as part of the Single Channel Objective Tactical Terminal (SCOTT) program managed by the Army. The FY 1985 program funds an advance design study to evaluate requirements and available technology. FY 1986 RDT&E funds advanced development of the Ground Mobile Forces (GMF) EHF satellite communications terminals to meet Air Force requirements for a small, highly mobile (man-transportable and para-droppable) satellite terminal which interoperates with other satellite terminals in the EHF frequency band. FY 1988 through FY 1990 RDT&E will complete full scale development of the man-transportable Ground Mobile Force Terminals. Procurement of the man-transportable Ground Mobile Forces Terminals will begin in FY 1990.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35887F
DOD Mission Area: #374 - Multimission, Technology & Support

Title: Electronic Combat Intelligence Support
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,822	1,928	1,593	1,812	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Electronic Combat (EC) Intelligence Support RDT&E funds support the development of Electronic Warfare (EW) Intelligence Support Data Files and the Threat Simulator Validation (SIMVAL) program. This is a high priority USAF project supporting all Air Force Electronic Combat programs.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,822	1,928	1,828		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	282	367	178	182	Continuing	N/A
Quantities	Not Applicable					

5. RELATED ACTIVITIES: This program supports all Air Force Electronic Combat programs.

It also interfaces with the basic intelligence analysis efforts funded by PE 31310F, Foreign Technology Division. Program element includes SIMVAL, EW Intelligence Support, C3CM Support Data Base, and a special access program.

6. (U) WORK PERFORMED BY: The Foreign Technology Division (FTD) at Wright-Patterson AFB, Ohio is responsible for Electronic Warfare (EW) Intelligence Support using in-house and contract resources. Current Electronic Warfare Integrated Reprogramming (EWIR) data file development is being accomplished by the Planning Research Corporation (PRC) field office at Dayton, Ohio. FTD is also responsible for the threat simulator validation program for new threat simulators under development. This work is currently accomplished by Applications Research Corporation (ARC) in Dayton, Ohio.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 35887F, Electronic Combat Intelligence Support

A. Project Description: The USAF has a current investment of [ ] in reprogrammable threat warning and jamming equipment to detect, display and jam enemy radar systems. [

] The Electronic Warfare Intelligence Support program at the Foreign Technology Division, Wright-Patterson AFB, Ohio will provide the intelligence information and parametric data on hostile threat emitters required to program these systems. Funds will also be used to develop a data file for hostile command, control, and communication (C3) elements. [

] The effectiveness of current and proposed EC systems is continually evaluated using threat simulators. [

] Fielded threat simulators are used in joint service exercises (Red Flag, Green Flag, Team Spirit), Development Test and Evaluation, and Operational Test and Evaluation programs. In addition, the Air Force Electronic Warfare Environment Simulator (AFEWES) has computerized threat simulations which are used for the test and evaluation of electronic combat equipment.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: The Foreign Technology Division enhances EW Intelligence support to Air Force programs through the development of software for data base management and [
] Validation effort began in support of the OSD sponsored HAVE PEWTER simulator program and several Air Force simulator development programs to include the MSQ-T13, WEST X, WEST XI, SADS VIM Hardware Update, SADS VIII, SAMS-11, and SARS VI. These simulators are located at Air Force electronic combat ranges and are used in support of EW equipment testing, tactics development, and aircrew training.

(2) FY 1985 Program: EW Intelligence Support efforts will focus on the continued development of [
] Work will begin on the development of a [
] and the automation of Intelligence Data Input Packages. Validation efforts will continue on the HAVE PEWTER, WEST X, WEST XI, SAMS-11, and SARS VI simulator programs. Validation testing will begin on the TWS-7, REDEYE, MPQ-T3, and SADS-IV simulators.

Program Element: #35887F
DOD Mission Area: #374 - Multimission, Technology & Support

Title: Electronic Combat Intelligence Support
Budget Activity: #4 - Tactical Programs

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continue to provide Electronic Combat (EC) intelligence support to Air Force electronic warfare and threat simulator programs. Continue validation testing initiated in FY 1985 on the TWS-7, REDEYE, MPQ-T3, SARS VI, and SADS IV simulators. Initiate validation efforts on the OSD sponsored HAVE COPPER simulator program, MPS-TYY, MSQ-T38, Comm Jammer, OBEWS, and WEST VI simulators. Continue the development of [ ] Initiate the development of a [ ] Cost estimates fall into Category IV. Level of effort is dependent on established EC intelligence support requirements and threat simulator development programs.

(4) (U) Program to Completion: Future validation efforts will be based on Air Force requirements for threat simulators, intelligence updates, and system modifications. Electronic Warfare (EW) Intelligence Support data sub-files will be developed and maintained to provide intelligence support to Air Force electronic combat programs. Work will begin on communications systems that will enhance user access to the EW Intelligence Support data base. This is a continuing program.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #41840F
DOD Mission Area: #356 - Mobility

Title: MAC Command & Control (C^2) System
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,227	3,413	11,441	8,042	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: There is a significant airlift shortfall in support of all major operations plans. The Military Airlift Command (MAC) must make optimum use of scarce airlift resources and must upgrade the MAC Command and Control (C^2) system. This program upgrades the MAC Command Post and develops and procures basic communications and information processing support to all C^2 echelons of the MAC system.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	3,227	4,413	5,322		Continuing	N/A
Other Procurement	5,964	9,065	3,318		Continuing	N/A

RDT&E: (U) Change in RDT&E funding in FY 1985 reflects Congressional reduction. The FY 1986 change adjusts program to accommodate refinement of operational concepts and revised cost estimates. In FY 1986 and 1987, the Automatic Communications Processor program has been transferred from Program Element 33131F, Minimum Essential Emergency Communications Network.

Procurement: (U) Changes in all years reflect realignment of tasks within PE 41840F which are accounted against MAC C^2 upgrade.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement*						
Funds	2,892	4,540	7,190**	22,926	Continuing	N/A
Quanitities	Not Applicable					

* Only that portion of the total procurement funding in PE 41840F dedicated to the MAC C^2 system upgrade is shown above. Other procurement funding provides the MAC consolidated aerial port subsystem and MAC Airlift Control Element (ALCE) reaction communications operation center.

** Includes funds for reprocurement data that will be converted to RDT&E via audit trail 1415 action.

5. (U) RELATED ACTIVITIES: Beginning in FY 1985, RDT&E funding for the ultra high frequency terminals is in PE 33605F, Satellite Communications Terminals.

PE #: 41840F

6. (U) WORK PERFORMED BY: Air Force Systems Command's Electronic Systems Division (ESD), Hanscom AFB, MA will provide overall program management. Specific contractors have not yet been identified. Jet Propulsion Laboratory, Pasadena, CA is designing the Information Processing System (IPS) testbed at McChord AFB.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 41840F, MAC Command and Control (C^2) System

A. (U) Project Description: The Military Airlift Command (MAC) requires the capability to rapidly and accurately exchange vital command and control information between ground C^2 elements and the aircraft. Moreover, there is minimal C^2 information processing support currently available to Continental United States (CONUS) Military Airlift Command (MAC) wings, and none available to overseas units. This program will develop interface and information processing equipment to integrate ultra high frequency (UHF) satellite communications and other communications media into an overall MAC Command and Control system. Equipment in this PE includes a data terminal primarily for aircraft installation and a standard local distributed processing network that will be interoperable with the airborne data terminal and, at appropriate command levels, with Department of Defense standard communications and automated systems. The Automatic Communications Processor (ACP) program, formerly part of the Adaptive High Frequency (HF) program, provides major improve in HF radio communications equipment through modifications to improve the performance of conventional HF assets including the ARC-190 airborne radio and the HF-80 series ground radios.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Agreement was reached to establish an Electronic Systems Division (ESD) detachment at Military Airlift Command (MAC) Headquarters in order to facilitate MAC C^2 enhancement activities. Initial Program Management Directives (PMDs) were issued for the Information Processing System (IPS) and the Tactical Data Station (TDS). Work was begun to develop Program Management Plans (PMPs) for IPS and TDS. ESD published a specification outline which interprets the TDS System Operational Concept (SOC). Work on the IPS SOC neared completion. The in-house developed IPS testbed in Europe (Tactical Information Management System - TIMS) was successfully used to support "Reforger 84." The wing testbed at McChord AFB was initiated and will be used as an IPS proof-of-concept.

(2) FY 1985 Program: Program Management Plans will be completed for the IPS, and the theater and wing testbeds will continue. The two testbeds will be merged into an interim testbed. Specifications will be defined and work on the Request for Proposal (RFP) will begin. For the TDS, specifications will be finalized.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The interim testbed will continue to serve as proof of concept, and will be used to refine MAC C^2 requirements and the technnical approaches to satisfy them. The IPS RFP will be completed and sent to bidders. The TDS contract will be awarded early in FY 1986 and Initial Operational Test and Evaluation will begin during the last quarter. In the Automatic Communications Processor (ACP) program, design and factory testing will be completed on a control module which will fit into the space and use the same wiring

as the current Air Force HF radio (ARC-190). Class II prototype modification will be accomplished and Initial Operation Test and Evaluation (IOT&E) will begin.

(4) Program to Completion: This is a continuing program. The Information Processing System and Tactical Data Station will be developed and implemented. The Information Processing System will be an evolutionary capability which, when the prototype system is initially fielded, will be analyzed, tested and enhanced to meet future requirements and to optimize its utility to MAC.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Establish Theater Testbed	2/FY 1984
(2) (U) Establish Wing Testbed	3/FY 1984
(3) (U) Establish Interim System	2/FY 1985
(4) (U) Award TDS Development Contract	1/FY 1986
(5) (U) TDS IOT&E	4/FY 1986
(6) (U) Award IPS Production Contract	1/FY 1987
(7) (U) TDS IOC	4/FY 1987
(8) (U) IPS IOC	2/FY 1989

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #44011F
DOD Mission Area: #207 - Special Operations Forces

Title: Special Operations Forces (SOF)
Budget Activity: #4 - Tactical Programs

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	13,993	20,756	11,748	46,497
3129	MC-130H	0	0	13,600	19,200	9,000	41,800
3173	Gunship Study	0	0	393	0	0	393
3174	AC-130H Sensor Upgrade	0	0	0	1,556	2,748	4,304

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Funds worldwide Special Operations Forces active force structure (Five Squadrons - Three CONUS, Two Overseas). Weapon systems include (Primary Aircraft Authorized) 10 AC-130H, 13 MC-130E, 8 HH-53H and 9 UH-1N aircraft. RDT&E and procurement funding required to procure 21 MC-130Hs is contained within this P.E. Aircraft are specially configured to perform long-range insertions, extractions, close air support/interdiction, psychological operations and other special functions in support of a full range of military operations.

The MC-130 COMBAT TALON is the only aircraft capable of night, all weather, long-range terrain following/avoidance infiltration, exfiltration, and resupply in medium to high threat environments.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Project 3129						
Aircraft Procurement:						
Funds	73,100	95,400	83,300	120,900	683,600	1,133,900
Quantities	2	2	1	2	12	20
Aircraft Modification:						
Funds			13,400			13,400
Quantities			1*			1

*Modifies CREDIBLE SPORT airframe to the MC-130H configuration.

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Military Construction: Funds Project 3129	0	0	6,170	0	3,380	9,550
Operations & Maintenance Funds Project 3129	0	0	1,600	2,300	Continuing	N/A

5. (U) RELATED ACTIVITIES: PE 64753F Combat Helicopter Modernization Program (HH-60A). The MC-130H derives its basic avionics architecture from the HH-60A R&D program. Common systems include software, displays, keyboard entry units, display electronics units, remote terminal units and Forward Looking Infrared (FLIR).

6. (U) WORK PERFORMED BY: The MC-130H program is managed by the Airlift and Trainer System Program Office (ASD/AF) at Wright-Patterson AFB OH. C-130 airframes are procured from Lockheed Corp, Marietta GA. IBM Federal Systems Division, Owego NY is the avionics systems integrator.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

Project: 3173, USSOUTHCOM Study. New start. This project provides for a feasibility study to determine suitable airframes for fixed-wing gunship operations. The program objective is to determine the optimum aircraft/weapons mix for use in low intensity conflict. Additionally, it provides for a feasibility study on equipping C-130 aircraft with a fixed Synthetic Aperture Radar (SAR).

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3129, MC-130H

A. (U) Project Description: This project provides for development of intermediate and depot (I and D) level Peculiar Support Equipment (PSE) for those systems common between the MC-130H and HH-60A. Interim Contractor Support is programmed to support MC-130H intermediate and depot level support requirements pending development and procurement of the required PSE.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable.

(2) (U) FY 1985 Program: Not Applicable.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: New start. RDT&E funds are requested in FY 1986 to begin development of intermediate and depot level avionics Peculiar Support Equipment (PSE) for the integrated COMBAT TALON II weapon system. The FY 1986 request funds initial development of PSE hardware, software, integration and test for those systems common between the MC-130H and HH-60A. Cost estimates are Category IV and were based on information developed from an HH-60 Independent Cost Analysis dated April 1984.

(4) (U) Program to Completion: Outyear RDT&E funding is programmed to complete development of the intermediate and depot level PSE and related technical data.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) MC-130H Support Equipment Development Contract Award	December 1985

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63431F
DOD Mission Area: #333 - Strategic Communications

Title: Space Communications
Budget Activity: #5 - Intelligence & Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		38,525	42,390	45,012	44,450	Continuing	N/A
1227	Terminal Segment	8,750	8,082	5,542	6,373	Continuing	N/A
2028	Space Segment	19,000	25,250	30,079	27,359	Continuing	N/A
2029	Space Comm Systems	10,775	9,058	9,391	10,718	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for advanced development of space communications system concepts, techniques, and technologies. Its purpose is to reduce the risk for future space communications systems by examining high risk exploratory research efforts and performing the advanced development needed to better assess their cost, schedule, and technical risk prior to committing large amounts of engineering development funds. The program identifies, develops, demonstrates, and evaluates the satellite and airborne terminal technology necessary to support global command, control, and data relay communications. This program provides the necessary transition step from laboratory basic research and exploratory development to the point where engineering development for a future space communications system can proceed.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	39,525	44,413	51,070		Continuing	N/A

- Congress cut $2.0 Million FY 1985 with no explanation
- Funds were reallocated by the Air Force in FY 1986 to support higher priority Air Force programs.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: Exploratory developments at the Air Force Avionics Laboratory (PE 62204F) and the Rome Air Development Center (PE 62702F) transition to this program element for advanced development. Satellite system planning and technology development is coordinated within the Air Force among other communications development program elements, with the Defense Communications Agency/Military Satellite Communications Office (DCA/MSO), and with companion Army and Navy efforts. This program also works closely with National Aeronautics and Space Administration (NASA) organizations involved in communications technology development such as the Lewis Research Center and the Goddard Spaceflight Center. When cost, schedule, and technical risk have been sufficiently identified and

reduced, the technology and concepts are transitioned to full scale development by the systems acquisition programs. Priority programs currently being supported include the Defense Satellite Communications System (PE 33110F) and Milstar (PE 33601F and PE 33603F).

6. (U) WORK PERFORMED BY: The overall program and Projects 2028 and 2029 are managed by Air Force Systems Command, Space Division, Los Angeles AFS, CA. Project 1227 is managed by Rome Air Development Center, Griffiss AFB, NY. Facilities supporting these efforts include: the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Electronic Systems Division, Hanscom AFB, MA; and the Air Force Geophysics Laboratory, Hanscom AFB, MA. The Advanced Space Communication program involves over 40 current or planned separate contracts. Major contractors are: McDonnell Douglas Aircraft Corporation, St. Louis, MO, for the space laser communications program; General Electric Corporation Valley Forge, PA, for active aperture and nulling antenna technology; Hazeltine Corporation, Long Island, NY, for the Extremely High Frequency (EHF) hybrid antenna; Questron Corporation, Santa Clara, CA, for magnetic bubble memories; TRW Systems Group, El Segundo, CA, and Hughes Aircraft Company, Culver City, CA, for solid state amplifiers; Hughes Aircraft Company, Torrance, CA, for traveling wave tube amplifiers and Raytheon Corporation, Wayland, MA, for the Super High Frequency/Extremely High Frequency (SHF/EHF) Airborne Terminal solid state amplifiers and Low Cost Antenna Pointing System. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA; the MITRE Corporation, Bedford MA; and Lincoln Laboratory, Lexington, MA.

7. (U) PROJECTS LESS THAN $10 MILLION FUNDING IN FY 1986:

A. (U) Project 1227, Terminal Segment Technology. This project evaluates space communications system airborne terminal requirements, assesses the technology available to meet those requirements, and conducts required additional technology developments; tests and evaluates technology developed; and assists operational systems in planning for evolutionary improvements in capability. In FY 1984, significant progress towards technical goals in efforts which directly impact Milstar terminal applications was made. This includes developments under the following technology areas: (1) Upgraded AN/ASC-30 Airborne Command Post Terminal; (2) Advanced airborne terminal; (3) Subsystem technologies, such as solid state amplifiers and advanced antennas; and (4) Advanced Extremely High Frequency (EHF) Force Element terminal studies. In FY 1985 and FY 1986, the transition of airborne command post terminal developments to engineering development will be accomplished. 44 Ghz Solid State Amplifier development will be completed. EHF Force Element terminal studies will be initiated. Subsystem technology efforts will be continued, such as the 20 GHz Low Noise Receiver, and transitioned to Milstar as appropriate. Testing of EHF communication links will be conducted using the ASC-30 terminal and the Fleet Satellite Communications EHF Package. Advanced microcircuit technology with the potential for reducing size, weight, and power of airborne terminals will be incorporated into terminals for evaluation. This is an advanced development program and planning cost estimates are based on engineering judgment and comparison with similar technology development efforts.

B. (U) Project 2029, Space Communications Systems Technology. This project accomplishes analyses of DoD Military Satellite Communications (MILSATCOM) developments, postulates MILSATCOM architecture impacts, develops EHF data link standards and data link architecture, investigates alternative system configurations for increased survivability, and identifies technologies for development. In FY 1984 work continued in support of satellite

communications technology development at Lincoln Laboratory. A military standard and users' handbook on low data rate Extremely High Frequency (EHF) uplinks and downlinks was published. Work defining operation concepts for future survivable interoperable satellite systems continued. A study to define the hardware needed to provide small, limited capacity EHF packages on satellites for jam resistant Telemetry, Tracking and Control was initiated, and support for Defense Communications Agency/Military Satellite Communications Office (DCA/MSO) architectural definition efforts for an Ultra High Frequency (UHF) satellite system and a future wideband system was provided. In FY 1985 and 1986, EHF data link standards efforts will be broadened to include higher data rates and crosslinks. Analyses of Military Satellite Communications (MILSATCOM) systems requirements and support to DCA/MSO architectural efforts will continue. Development of future wideband system options will continue and technology development performance goals will be recommended. Lincoln Laboratory support will continue. This is an advanced development program and planning cost estimates are based on engineering judgment and comparison with similar technology development efforts.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2028, Space Segment Technology

A. (U) Project: This project evaluates space communications system spacecraft requirements and assesses the technology available to meet those requirements; develops configurations, subsystems and components for spacecraft to meet identified technology requirements for new or improved space segments of space communications systems; and tests the hardware developed for performance and reliability to assure its utility to future operational systems.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Significant progress towards technical goals was made in the several technology areas under development within this project. The specific technology areas with developments underway which support future MILSATCOM systems are: (1) Solid State power amplifiers; (2) Generic Travelling Wave Tube (TWT) program and Monitored Production Line; (3) Nulling and active aperture antennas; (4) Extremely High Frequency (EHF) Signal Processor/Components and subsystems; and (5) 44 GHz Low Noise Receivers.

(2) (U) FY 1985 Program: Development and testing of power amplifier, antenna, processor and low noise receiver technologies for Milstar and future wideband service will be continued. The generic TWT program will continue and delivery of flight TWTs will be made. Laser communication component and subsystem development for space data link applications will be initiated.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Development and testing of power amplifier antenna, processor and low noise receiver technologies for Milstar and future wideband service will be continued. Generic TWT designs for future higher power applications will be initiated. Laser communications component and subsystem development for space data link applications will be continued. This is an advanced development program and planning cost estimates are based on engineering judgment and comparison with similar technology development efforts.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones	Date
(1)	(U)	Generic Travelling Wave Tube Program	
		- 20 GHz Critical Design Review	November 1984
		- Monitored Production Line Initiation	June 1985
(2)	(U)	20 GHz Active Aperture Antenna Development Completed	June 1985
(3)	(U)	Wideband Service Nulling Subsystem Completed	September 1986
(4)	(U)	Solid State Power Amplifiers	Continuing

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #31305F
DOD Mission Area: #312 - General Defense Intelligence Program (GDIP)

Title: Intelligence Production Activities
Budget Activity: #5 - Intelligence and Communications

1. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0					
3081	Image Data Exploitation II (IDEX II)	0					

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This project is required to ensure that major USAF GDIP organizations are capable of exploiting the in imagery in the Without this digital imagery exploitation capability, these organizations will to provide to intelligence data bases.

3. COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	0
Other Procurement	0

- Increases in FY 1986 and "total estimated cost" (RDT&E) result from program repricing to incorporate DOD unique design requirements and revised inflation indices.

- Increase in FY 1986 (Procurement) results from initial acquisition of long lead items necessary for outyear fabrication of the softcopy devices and revised inflation indices.

4. OTHER APPROPRIATION FUNDS: ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	Other Procurement Funds	0					
	Military Construction Funds	0					

5. (U) RELATED ACTIVITIES: A Memorandum of Agreement between the services and DIA establishes the USAF Assistant Chief of Staff, Intelligence as the Department of Defense (DOD) Executive Agent for GDIP softcopy (digital) exploitation devices. As Executive Agent, he is responsible for ensuring that the Image Data Exploitation (IDEX II) devices being developed by the Central Intelligence Agency (CIA) satisfy the operational needs of Army, Navy, USAF and Defense Intelligence Agency (DIA) GDIP organizations.

(U) The MOA outlines the management relationships among the Services and DIA and establishes the DOD National Foreign Intelligence Program Softcopy Steering Committee to provide management oversight, policy making and requirements definition approval. A second MOA between the executive agent and CIA establishes a DOD contingent within the CIA Softcopy Exploitation System Joint Program Office (SES/JPO) to ensure day-to-day coordination between the Softcopy Steering Committee and the CIA development effort. It also outlines management relationships between the Executive Agent and CIA. Within the USAF, Program Management Directive (PMD) No. 3110 is the governing directive for Air Force Systems Command personnel, representing DOD, to participate in the IDEX II Program.

(U) The specific relationships of this project with other projects and program elements cannot be adequately addressed this classification level. These relationships are addressed in the FY 1985 National Foreign Intelligence Program Congressional Budget Justification Book, Volumes II, III, and IV.

6. (U) WORK PERFORMED BY: To be determined.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3081, Image Data Exploitation II (IDEX II)

Program Element: #31305F
DOD Mission Area: #312 - General Defense Intelligence Program (GDIP)

Title: Intelligence Production Activities
Budget Activity: #5 - Intelligence and Communications

A. Project Description: Provides for development and procurement of a digital imagery exploitation system. This system is required to ensure that USAF GDIP organizations are capable of timely and efficient exploitation of the of imagery data in the

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Complete requirements definition and architecture. Complete generic softcopy concepts of operation and continue site specific concepts of operation. Initiate site surveys at proposed DOD IDEX II sites to determine site modification requirements.

(2) (U) FY 1985 Program: This is an FY 1985 new start. The RDT&E funding within this project reflects the Department of Defense (DOD) share of Image Data Exploitation (IDEX II) development costs. Procurement funding within the project reflects the DOD share of long lead items necessary for outyear fabrication of the IDEX II devices. Operations & Maintenance (O&M) funding completes site specific concepts of operation, completes site surveys, and provides support to the DOD contingency in the Central Intelligence Agency Softcopy Exploitation System Joint Program Office.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Continued incorporation of DOD-unique required capabilities into IDEX-II development. Develop required interfaces with the Army/Air Force Intra-theater Imagery Transmission System (IITS) and the Navy Fleet Intelligence Support Terminal (FIST); host data bases; DIA support systems.

(4) (U) Program to Completion: Remaining outyear tasks include completion of system design, development, fabrication of the systems, site preparation, system testing, establishment of logistical support, and delivery.

C. (U) Major Milestones:

	Milestones	Dates
(1) (U)	Source Selection	January 1985
(2) (U)	Initial Operational Capability	July 1988
(3) (U)	Full Operational Capability	August 1990

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33110F
DOD Mission Area: #333 - Strategic Communications

Title: Defense Satellite Communications System (DSCS)
Budget Activity: #5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		34,936	31,599	6,930	15,214	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Satellite Communications System (DSCS) provides super high frequency satellite communications for secure voice and high data rate transmissions. It satisfies unique and vital national security communications requirements for worldwide military command and control, crisis management, relay of intelligence and early warning data, treaty monitoring, and diplomatic traffic. Specifically, the DSCS supports the National Command Authorities, the Worldwide Military Command and Control System, the Defense Communications System, the Diplomatic Telecommunications Service, the White House Communications Agency and mobile forces of all Services. There is a continuing requirement for this communication service. The procurement appropriations request for the next seven satellites is based on a negotiated multiyear contract. The estimate for the last three satellites is based on annual contract costs of similar satellites acquired in prior years. These three additional satellites, over and above the original DSCS program, were added to bridge the gap between the current DSCS and a possible DSCS follow-on program to provide continuing global, wideband communications service into the mid-1990's.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	39,836	31,629	3,104		13,284	359,900
Missile Procurement	115,704	291,238	149,530		252,984	1,240,900

RDT&E Changes

FY 84 - Reduced by $4.9 million since the first-time integration for the space shuttle launch of the first production DSCS III pair was less than estimated, and a planned launch was delayed so that the DSCS booster could be reallocated to a higher priority program.

FY 85 - Reduced $30 thousand due to undistributed Congressional reduction.

FY 86 - Increased $3.8 million to accomplish non-recurring engineering of last DSCS IIIs for parts obsolescence/availability and new upper stage.

To Completion - Development of future DSCS satellites will be funded in this program element

Missile Procurement Changes

FY 85 - Reduced by $40 million as part of the multiyear procurement initiative for the next seven DSCS III satellites and $800 thousand due to undistributed Congressional reduction.

To Completion - Future DSCS satellites will continue to be funded in this program element.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimate Cost
Missile Procurement						
Funds	107,703	250,400	149,166	184,511	Continuing	N/A
Quantities	0	2	2	2		
Operations and Maintenance	4,283	8,500	9,452	7,095	Continuing	N/A

5. (U) RELATED ACTIVITIES: The Defense Communications Agency is responsible for overall Defense Satellite Communications System program management, system engineering, and satellite operational direction. The Army develops and procures ground terminals under Program Element 33142A, Defense Satellite Communications System. The Navy procures shipborne terminals under Program Element 33109N, Satellite Communications System. In addition to its responsibility for the space segment, the Air Force develops and integrates airborne terminals under Program Element 11312F (Post Attack Command and Control System) and Program Element 32015F, National Emergency Airborne Command Post. The Air Force also provides launch services for the Titan III launch vehicle under Program Element 35119F, Space Boosters. Inertial Upper Stage procurement and recurring integration and Space Shuttle launch support will be furnished under Program Element 35171F, Space Launch Support. The Advanced Space Communications Program, Program Element 63431F, develops and demonstrates evolutionary communication satellite technologies for future satellite programs. The Air Force also has funding for ground equipment, construction, operations and maintenance, and manpower to support its portion of the ground segment in PE 33605F, Satellite Ground Terminals.

6. (U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles AFS, CA, is responsible for the space segment of the Defense Satellite Communications System. TRW, Redondo Beach, CA, is the prime contractor for the DSCS II satellites. General Electric Company, Valley Forge, PA, is the prime contractor for the DSCS III spacecraft. The Aerospace

Corporation, El Segundo, CA, provides general systems engineering and integration to the Air Force Space Division System Program Office.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 33110F, Defense Satellite Communications Systems

A. (U) Project Description: See paragraph 2

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: A contract was awarded in January 1984 for the economic order quantity (EOQ) advance procurement of long lead items for the next seven DSCS III satellites. A firm fixed price multiyear contract associated with this EOQ was negotiated and the contract was awarded in November 1984.

(2) FY 1985 Program: RDT&E will be completed for a major activity, first time integration of initial production satellites on the Space Shuttle/Inertial Upper Stage. RDT&E will also be completed on two efforts that will ultimately be implemented as product improvements: solid state amplifiers and improved frequency band filters. These component improvements enhance system reliability and performance and will not significantly change the basic satellite design. The first two production satellites will complete testing the second pair of production satellites Production of the next seven DSCS III satellites will begin as a continuation of the multiyear procurement initiated in FY 1984 with the economic order quantity advance procurement. In FY 1985, advance procurement for non-long lead parts, materials, and subcontractor sub-assembly fabrication for the seven satellites will provide economic order quantity savings. Also, the production of the first two of these satellites will be fully funded. DSCS III is a mature program which has completed Defense Systems Acquisition Review Council (DSARC) milestone III and has already procured seven satellites. The cost estimates are of high confidence (Level I). They are based on negotiated prices for multiyear procurement of the next seven satellites.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Acquisition of the seven multiyear satellites will continue with two more satellites fully funded from the procurement appropriation. RDT&E funds the on-orbit incentives for the initial DSCS III development satellites. Following the multiyear contract in FY 1988, three more satellites will be procured. Starting in FY 1986, RDT&E funds will be used for design changes on the three satellites. These changes are necessitated by parts unavailability/obsolescence and a new upper stage. The cost confidence for the parts-caused redesign is level III, budgetary; redesign for the new upper stage is level V, planning.

(4) Program to Completion: The next two multiyear DSCS III satellites will be funded in 1987 and the last one in 1988. Also in 1987, the long lead items for the next three DSCS III satellites will be procured under an economic order quantity approach; these three satellites will be acquired under single annual contracts starting in 1988. An additional DSCS III will be procured in FY 1991 and dual-launched with the DSCS III procured in FY 1990. DSCS III pairs will be launched on the space shuttle [ ] Non-recurring first time integration onto the new upper stage will be RDT&E funded starting in FY 1991. Although this is a continuing program there is no definition or identified funding for satellites that would be acquired after the 18th DSCS III.

C. Major Milestones:

	Milestones	Dates
	Defense Satellite Communications System II	
(1) (U)	Initial Contract Award	March 1969
(2) (U)	Initial Satellite Launch	November 1971
(3) (U)	Launch of Final Production satellite (with DSCS III-A1)	October 1982
(4)	Remaining satellite launch (with DSCS III-A2) *	
	Defense Satellite Communications System III	
(5) (U)	Defense Systems Acquisition Review Council I	December 1974
(6) (U)	Award Phase I (Preliminary Design) Contracts	December 1975
(7) (U)	Preliminary Design Review	October 1976
(8) (U)	Defense Systems Acquisition Review Council II	December 1976
(9) (U)	Award Phase 2 (Engineering Development) Contract	February 1977
(10) (U)	Defense Systems Acquisition Review Council III Production Decision	December 1981
(11) (U)	Launch First Demonstration Flight Satellite	October 1982
(12)	Launch Second Demonstration Flight Satellite *	
(13)	First production satellite launches on Shuttle	
(14)	Refurbished qualification satellite launch availability	
(15)	DSCS III Full Operational Capability (6 orbiting satellites)	
(16) (U)	Delivery of last DSCS III multiyear procured satellite	March 1991

* Data presented in FY 1985 Descriptive Summary

EXPLANATION OF MILESTONE CHANGES

(4 & 12)

Budget Activity: 5, Intelligence and Communications
Program Element: 33110F, Defense Satellite Communications System (DSCS)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): DT&E for the Defense Satellite Communications System (DSCS) II Space Segment is complete. For DSCS III, DT&E was separated into two phases. During Phase One, which extended from Defense Systems Acquisition Review Council I in December 1974 to Defense Systems Acquisition Review Council II in December 1976, development tests were conducted to demonstrate technical feasibility.

(U) The objective of Phase Two DT&E was to verify the design and attain the highest confidence in DSCS III performance. Phase Two testing consisted of three parts: in-plant, launch base, and on-orbit. The in-plant tests provided the performance baseline for production and consisted of: development testing using thermal, structural, and development models; piece part, component and subsystem qualification; and system level qualification model satellite tests to confirm design integrity in a realistic, simulated orbital environment. During launch base testing, the satellite was tested to verify its launch readiness. After launch, on-orbit testing consisted of: (1) immediate post-injection evaluation of the performance of satellite support subsystems conducted by the Air Force Space Division via the Air Force Satellite Control Facility; (2) verification of communications subsystem and Super High Frequency tracking, telemetry, and command performance via the Camp Parks, CA test terminal; and (3) evaluation of interoperability with varied earth terminals and the Satellite Configuration Control Element.

(U) System level qualification satellite testing was conducted from June 1980 to May 1981. The Qualification Test Satellite was subjected to electromagnetic compatibility tests, acoustic, pyro shock, thermal balance, and thermal vacuum environmental tests. The qualification satellite completed system level integration, radio frequency compatibility, electrical system baseline tests and thermal vacuum tests. The results of completed tests indicate that demonstrated performance meets specification requirements.

(U) All subsystems for the first DSCS III satellite completed acceptance tests and were integrated in the satellite. System level acceptance testing started in July 1980. The results of completed tests indicate demonstrated performance meets specification requirements. All components and subsystems passed; no major waivers were required and no major design problems were uncovered. The first satellite passed acceptance tests in June 1981. The first DSCS III spacecraft, paired with a DSCS II, was launched on 30 Oct 82. The on-orbit portions of DT&E were successfully completed in January 1983. The satellite met or exceeded all performance specifications. The first DSCS III satellite was declared o be an operational asset by the Defense Communications Agency in May 1983.

Budget Activity: 5, Intelligence and Communications
Program Element: 33110F, Defense Satellite Communications System (DSCS)

2. (U) Operational Test and Evaluation (OT&E): The Defense Communications Agency (DCA) manages the overall DSCS program which includes the space and terminal segments. The Air Force System Command's Space Division (SD) is responsible for the acquisition, deployment, testing, and operational support of the space segment. The US Army is the executive agent for all ground terminal procurement, installation, and testing. Terminals delivered to the Air Force are addressed in PE 33605F.

(U) Space Segment. The DSCS III space segment consists of the satellites and Satellite Configuration Control Elements (SCCE). To date, the space segment testing has consisted of three phases beginning with the launch of the first DSCS III satellite on 30 October 1982. Phase I, initial on-orbit test and evaluation was conducted by the USAF Space Division and completed on 7 January 1983. The conclusions were that all major system interfaces and functions had been demonstrated satisfactorily and that the initial performance of the satellite warranted proceeding into the second phase, the Initial Joint Operational Test and Evaluation (IJOT&E). IJOT&E was conducted concurrently with the third phase of testing, Joint Development Test and Evaluation (JDT&E). JDT&E was managed by the US Army Satellite Communications Agency and directed from Fort Monmouth, NJ. The purpose of JDT&E was to evaluate, in a system test environment, the engineering performance of the satellite and the SCCE engineering development model and the interoperability of the satellite with the representative earth terminals.

(U) IJOT&E was conducted between 17 January and 17 March 1983, in conjunction with JDT&E, by the Army Operational Test and Evaluation Agency with the assistance of the Air Force Operational Test and Evaluation Center and the Air Force Communications Command. The operational testing was adequate for a complete evaluation of mission performance, organization, reliability, availability, maintainability, and safety and human factors. The operational testing was adequate for a partial evaluation of vulnerability/ survivability, training, and logistics. The satellite and SCCE were very similar to their production counterparts.

(U) The overall conclusions of the IJOT&E were:

(U) The DSCS III-A1 satellite and SCCE engineering development model demonstrated operational effectiveness during IJOT&E.

(U) The operational suitability was also adequate despite an initial low mean time between failure of the SCCE. Much of the early SCCE downtime was due to recurring software and hardware problems that were corrected. Action has also been taken to improve the reliability of subsequent production equipments, which are managed by the Army.

(U) The jammer detection and nulling capability of the system performed better than specification requirements.

(U) The formal training provided for SCCE crews was adequate. However, proficiency must be achieved and sustained through periodic training exercises.

Budget Activity: 5, Intelligence and Communications
Program Element: 33110F, Defense Satellite Communications System (DSCS)

3. System Characteristics:

(U) Technical Characteristics	Objective*	Current Estimate	C/ Demonstrated
(U) Frequency (Gigahertz)	7.25-8.4	7.25-8.4	7.25-8.4
(U) Bandwidth (Megahertz per channel)	50-85	50-85	50-85
(U) Effective Isotropic Radiated Power (decibels)			
a. Channels 1 & 2 (EC/Spot/AC(Dish)) A/	29/40/44	29/40/44	29/40/44
b. Channel 3 (EC/EC/Spot)	25/23/34	25/25/34	25/25/34
c. Channel 4 (EC/EC/Spot/AC(Dish))	25/23/34/38	25/24/35/38	25/24/35/38
d. Channels 5 & 6 (EC)	25	25	25
e. Beacons (EC)	12	12	12
(U) Signal Gain to System Noise Temperature Ratio (decibels per degree Kelvin)			
a. Earth Coverage Horn	-15	-13	-13
b. Earth Coverage Multiple Beam Antenna	-16	-15	-15
c. Spot Multiple Beam Antenna	-1	-0.5	-0.5
Nulling (decibels below EC reference) Receive Multiple Beam Antenna B/			

(U) A/ EC - Earth Coverage; Spot - 1.0° minimum diameter; AC - Area Coverage; Dish - 3.5° beam diameter switchable on orbit to desired channel.
B/ Based on a single null anywhere in the satellite field of view created within an earth coverage pattern.
C/ Demonstrated performance based on the results of system level qualification satellite testing.

*The Objectives are Decision Coordinating Paper (DCP) values translated into contract requirements. In some cases, success in the development phase resulted in contract requirements for better performance than identified in the DCP.

Budget Activity: 5, Intelligence and Communications
Program Element: 33110F, Defense Satellite Communications System (DSCS)

(U) Operational Characteristics	Objective	Current Estimate	Demonstrated
(U) Quantities (per satellite)			
40 Watt Traveling Wave Tubes (TWT) (Channels 1 and 2)	2	2	2
10 Watt TWTs (Channels 3 thru 6)	4	4	4
Command Links	2	2	2
Protected Beacons	2	2	2
(U) Satellite Reliability A/	0.7	0.7	TBD D/
(U) Launch Vehicle (types) B/	Titan IIIC Titan 34D/IUS STS/IUS	Titan 34D/IUS Titan 34D/Transtage STS/IUS	Titan 34D/IUS
(U) Weight (lbs) C/	1650	1866	1866

A/ Probability of survival at 7 years
B/ IUS - Inertial Upper Stage: STS - Space Transportation System (Space Shuttle)
C/ On-orbit satellite weight less expendables (dry weight)
D/ Long-term, system reliability not proven, but a 0.75 reliability has been demonstrated by piece part analysis

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

(U) There was no activity in 1984. JDT&E and IOT&E were performed in 1982 and 1983.

T&E Activity (Next 12 Months)

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33112F
DOD Mission Area: #360 - Support and Base Communications

Title: Air Force Communications
Budget Activity: #5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	978	1,077	1,077	3,132
3118	Mission Effective Information Transmission Systems	0	0	978	1,077	1,077	3,132

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is an FY 1986 new start. The project provides an essential capability to effectively transmit data, voice, alarm/sensor data, video, etc. to and from command centers, data processing centers, telecommunications facilities, logistics support centers, and management headquarters. The capabilities provided will alleviate operational deficiencies which currently hamper command and control information transfer (voice, data and video), transmission of logistics management data, and support of energy monitoring systems, security alarm systems, and intelligence collection and dissemination systems. This project is in response to Air Force Communications Command (AFCC) Statement of Need 04-82 (validated), Modernized Base Level Information Transmission System. The existing base transmission systems were designed, engineered and installed to support analog voice (telephone) services. Technological limitations of these existing systems preclude effective expansion without fundamental restructuring and upgrade.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	0	0	5,413	7,275	77,680	90,368
Quantities	Not Applicable					

5. (U) RELATED ACTIVITIES: Not Applicable

6. (U) WORK PERFORMED BY: Electronic Systems Division (ESD) Hanscom AFB, MA, of Air Force Systems Command (AFSC) will be the in-house developing organization responsible for the program.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3118, Mission Effective Information Transmission Systems

Program Element: #33112F
DOD Mission Area: #360 - Support and Base Communications

Title: Air Force Communications
Budget Activity: #5 - Intelligence and Communications

A. (U) Project Description: See paragraph 2.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable.

(2) (U) FY 1985 Program: Not Applicable.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Establishes program management office, modernizes transmission systems of two bases, and initiates architectural study and analysis (Research, Development, Test and Evaluation) to address: (a) evolutionary enhancements required to meet interoperability and security (classified and other sensitive information) requirements associated with transmission support to distributed information systems; (b) integration of transmission system upgrade efforts into ongoing information systems programs (e.g., modernization of base-level data processing, capital-replacement of telephone switching systems, development of local area networks, etc.). Planning cost estimates (Category IV) of September 1984 are based on level-of-effort required for a task order contract.

(4) (U) Program to Completion: Continues modernization of base transmission systems (5 bases FY 1987, 5 bases FY 1988, 10 bases FY 1989, 14 bases FY 1990). Completes architectural study and analysis (FY 1987-88) to provide high leverage over ongoing and subsequent modernizations.

C. (U) Major Milestones:

	Milestones	Dates
(1) (U)	Assessment of Alternative System Control Concepts	3rd Qtr FY 1986
(2) (U)	Recommendations on Internet Interfaces, Gateways and Protocols	3rd Qtr FY 1986
(3) (U)	Evaluation of Concepts for Base Information Systems Security and Survivability	4th Qtr FY 1986
(4) (U)	Recommended Base Information Systems Architectures: System and Subsystem Configurations, Transition Concepts	2nd Qtr FY 1987
(5) (U)	Interim Technical Implementation Guidelines	3rd Qtr FY 1987
(6) (U)	Detailed Implementation Planning and Evaluation for Model Bases	4th Qtr FY 1987
(7) (U)	Revised Technical Implementation Guidelines	2nd Qtr FY 1988
(8) (U)	Operations and Maintenance Concepts and Specifications for Major Subsystems	4th Qtr FY 1988

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33126F
DOD Mission Area: #393 - Long Haul Communications

Title: Long Haul Communications - DCS
Budget Activity: #5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8,323	9,329	11,543	11,716	Continuing	N/A
2022	Automated Digital Communications Processing	1,167	2,288	3,458	3,350	Continuing	N/A
2155	Systems Control	2,046	1,435	3,854	3,900	Continuing	N/A
2157	Transmission Improvements	[illegible],465	3,335	3,820	4,066	Continuing	N/A
2206	Digital European Backbone (DEB)	195	191	216	200	Continuing	N/A
2440	Secure Voice Improvement Program (SVIP)	112	2,080	195	200	Continuing	N/A
2953	Movements Information Network	1,138	0	0	0	0	2,169
2981	Defense Data Network/SAC Digital Network Interface	2,200	0	0	0	0	2,200

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is the Air Force portion of the tri-service RDT&E program for the Defense Communications System (DCS). The DCS provides the long distance, common user, switched telecommunications network to satisfy requirements of the National Command Authorities, the Department of Defense, and certain other government agencies. The DCS RDT&E program defines system and subsystem architecture, specifies design parameters, and develops telecommunications technology for DCS modernization and improvement. Work in this program element provides for an orderly transition to a second generation DCS, characterized by new digital transmission and switching subsystems, and determines the architecture for the third generation DCS, where the focus will be on unified direction and control and subsystem interaction between differing switched networks, e.g., voice and data. It includes technology development and subsystem implementation in automated digital communications processing and distribution techniques, performance assessment and network management, and transmission improvements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,123	9,329	11,543		Continuing	N/A
Other Procurement	18,965	22,644	32,663		Continuing	N/A

FY 1984: Other Procurement funding was revised due to changes in the DEB installation schedule. RDT&E was revised due to the requirement for the Defense Data Network/SAC Digital Network interface.

FY 1985: Other Procurement funding was revised due to changes in the DEB and SVIP programs.

FY 1986: Other Procurement funding was revised because the Digital European Backbone (DEB) and the Secure Voice Improvement Program (SVIP) programs were stretched out.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:						
TOTAL	12,038	23,500	18,963	36,839	Continuing	N/A
Project 2206 (Digital European Backbone)						
Funds	12,038	23,011	11,563	35,139	Continuing	N/A
Quantities		Not Applicable				
Project 2440 (Secure Voice Improvement Program)						
Funds	0	489	7,400	1,700	Continuing	N/A
Quantities		Not Applicable				
Military Construction:						
Project 2206 (Digital European Backbone)						
Funds	0	5,650	580	2,745	5,882	14,857
Quantities		Not Applicable				

5. (U) RELATED ACTIVITIES: The DEB project (2206) involves tri-service funding and includes installation of equipment at Army, Navy, and Air Force sites. Overall program management for this project is exercised by the Defense Communications Agency (DCA). All projects are part of the DCS RDT&E program as documented in DCA's Five Year Program Each Service budgets money to support work directed by the DCA Plan. Acquisition of communications security equipment through the National Security Agency to support Project 2440 is funded under Program Element 33401F, Communications Security. Other Procurement funds (FY 1986) for the Secure Conferencing Program (SCP) are included in Project 2440. RDT&E for SCP is funded under Program Element 63735F, World-wide Military Command and Control System Architecture.

6. (U) WORK PERFORMED BY: Air Force Systems Command manages this program element through the Electronic Systems Division (ESD), Hanscom Air Force Base, MA (Projects 2206 and 2440) and the Rome Air Development Center, Griffiss AFB, NY (Projects 2022, 2155 and 2157). Electronic Systems Division receives technical support from the MITRE

Corporation, Bedford, MA. Other major contractors are: Computer Sciences Corporation, Falls Church, VA; ITT, Nutley, NJ; Honeywell, Tampa, FL; RCA, Camden, NJ; and, Signatron Inc, Lexington, MA. All of these support the tasks managed by the Rome Air Development Center (RADC). Other contractors (total value, $7.2 million) are: Digital Communications Corporation, Germantown, MD (Project 2157); Western Union, McLean, VA (Project 2022); Ford Aerospace and Communications Corporation, Colorado Springs, CO (Project 2022); Harris Corporation, Melbourne, FL (Project 2157); Hazeltine, Greenlawn, NY (Project 2157); and Raytheon, Sudbury, MA (Project 2157).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2022, Automated Digital Communications Processing. As the Defense Communications System (DCS) transitions from an analog to an all digital system, new capabilities will emerge. Systems to exploit these capabilities will be designed and tested under this project. First is a Multinet Gateway element which will enable multi-level secure (MLS) interfaces between the DCS and other digital networks, e.g. commercial systems. The ability to connect the DCS to other digital networks in a secure way will significantly improve survivability by providing more alternate routing possibilities should segments of the DCS fail in crisis situations. Second is an initial series of tests to define and evaluate performance parameters for the Defense Switched Network, the follow-on to the current Automatic Voice Network (AUTOVON). The Experimental Integrated Switched Network (EISN) consisting of an Air Force node at RADC, as well as Army and Defense Communications Agency (DCA) nodes, will be the test-bed. In FY 1984 adaptive routing, use of mixed transmission media (i.e., satellite and terrestrial), and multilevel priority and preemption concepts were evaluated using the EISN. Development of the Multinet Gateway continued in FY 1984, and an internet MLS Security Model which meets DOD security policies was completed as the first step in the security certification process. In FY 1985 four advanced development gateway models will be delivered to the Defense Data Network Program Management Office for evaluation. In FY 1985 we will also begin to investigate using Artificial Intelligence in the development of routing algorithms in the DCS. Six advanced development gateway models will be delivered in FY 1985 for extensive tesing in an internet environment. Additional security certification work on the Multinet Gateway, as well as minor improvements to the Multinet Gateway itself, are also scheduled for FY 1985. In FY 1986 the Enhanced Internet Routing Device, an adjunct to the Multinet Gateway, will be developed. Work will begin on an advanced development model of a Worldwide Digital Systems Architecture processor, a device which will dynamically allocate integrated voice and data communications trunks. Additional test programs to evaluate circuit switching techniques will continue on the EISN. In addition, testing will begin on an internetted system of Multinet Gateways, and the MLS certification process will continue.

B. (U) Project: 2155, Systems Control. This project will improve DCS network management and control by developing techniques, hardware, and software to provide improved performance assessment, failure detection, failure isolation and reporting, and restoral and reconstitution on a worldwide basis. In May 1984, field testing of the AUTOVON Network control subsystem (ANCS) was completed and preparations were made to turn it over for operational use. In August 1984 the evaluation of the Western Electric Digital Access and Cross-Connect System for use in the DCS was fin-

ished. An experimental system control model was used to evaluate Electromagnetic Countermeasures signal discrimination and identification techniques for application in the Defense Communications System (DCS). In early FY 1985, the Air Force will formally integrate the AUTOVON Network Control Subsystem capabilities into the AUTOVON Network Data Control System. A second major effort is the Base/Access Area Automated Reporting System (BAAARS) which will apply fault isolation techniques to local subscriber networks. Development of this system in FY 1985 will include a field evaluation at Kirtland AFB, NM and transition to the Air Force Communications Command. Development of an Integrated DCS Control System will begin in mid-FY 1985. This project is to set the baseline for coordination and correlation of DCS long-haul control. Also in mid-FY 1985, work will begin on a Base Information System Management Center which will coordinate the control of on-base information systems. Starting in FY 1986 we will produce an advanced development model to test the ability of DCS technical controllers to rapidly differentiate between natural and intentional interference in order to enable them to expedite corrective actions. A major project will be undertaken to emulate switching and system contol scenarios which will be used to evaluate future DCS improvements. Additionally, we will develop a capability for automated routing and control of dedicated circuits.

C. (U) Project: 2157, Transmission Improvements. This project will improve transmission survivability, efficiency, capacity and reliability of Air Force and DCS communication links by applying new techniques such as millimeter wave and fiber optics, and by developing equipment embodying new Electronic Counter-Countermeasures (ECCM) technology. In FY 1984 vulnerability assessment of DCS troposcatter and microwave line-of-sight radios continued, with results incorporated into ECCM developments in both media. Three other major developments also continued: (1) narrowband high frequency radio with jam resistance, high data rates, and improved voice recognition features; (2) an advance development model of a multi-node, multi-rate digital microwave radio with ECCM features, including adaptive antenna nulling; and (3) a high power amplifier for troposcatter radios which will increase efficiency up to 70 percent and reliability by 300 percent. An ECCM tropo modem and adaptive antenna and processor was developed and successfully tested against airborne jammers. This equipment represents the first mainbeam nulling capability demonstrated over troposcatter channels. In 1985 development of a troposcatter angle diversity retrofit kit for use in Digital European Backbone (DEB) radios will begin. This kit will employ advanced diversity combining techniques to more efficiently use the frequency spectrum. Development of the narrowband HF radio, microwave line-of-sight ECCM radio and troposcatter high power amplifier will continue. Vulnerability assessment of DCS troposcatter and microwave radios will be completed. Development of an advanced timing distribution subsystem will begin in FY 1986 to support the transition of the DCS to a predominantly digital communications system. The narrowband HF ECCM capability will also be demonstrated. Development of the microwave line-ofsight ECCM radio will be completed and ready for transition to acquisition. Vulnerability measurement and assessment of millimeter wave radios will begin.

D. (U) Project: 2206, Digital European Backbone (DEB). DEB is the approved program for digital upgrade of the DCS in Europe. The program stems from the National Command Authority's direction to secure DCS links, the rapid growth of high speed data requirements, and major force redeployments in Europe, such as the Ground Launched Cruise Missile. One phase of DEB was completed in 1979. The remainder of DEB is planned to use the DCS standard digital radio and multiplex equipment known as DRAMA. The first segment of DEB using DRAMA became operational in June 1984. The remainder of the DEB upgrade will extend the improved operation from the Nothern Atlantic to Italy and Spain.

The upgrade is scheduled to be completed by 1990. The Air Force is the Lead Military Department for the overall upgrade, while the Army is the Lead Military Department for procuring the radio equipment.

E. (U) Project: 2440, Secure Voice Improvement Program (SVIP). SVIP is a tri-service program, with the Army as executive agent, to provide a high quality worldwide DOD secure voice network. The program was restructured in FY 1980 per Congressional direction and currently includes the acquisition of the Automatic Secure Voice Life Cycle Extension Program modulation/demodulation equipment. FY 1984 funds were used for joint service testing of the new militarized secure voice terminal. Procurement of terminals will begin in FY 1985. Development of a radio wire-line interface is planned for FY 1985, in phase with the Secure Conferencing Project of Program Element 63735F. In FY 1986 procurement and installation of SVIP terminals will continue at a level consistent with validated user requirements.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 33144F
DOD Mission Area: 360 - Support & Base Communications

Title: Electromagnetic Compatibility Analysis Center (ECAC)
Budget Activity: 5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		7,104	6,864	7,191	7,670	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense (DOD) Center operated by the Air Force by authority of Department of Defense Directive 5160.57, "Electromagnetic Compatibility Analysis Center." The creation of the Center stemmed from Defense Department recognition that a central agency was required to provide support to the military services in dealing with the increasing number and severity of electromagnetic compatibility problems. The Center is tasked with the responsibility of developing a communications-electromagnetic systems data base and the analysis tools necessary to determine if these systems will operate in their intended electromagnetic environment. This program element provides core funding to support data base and analysis capability development and specific analysis tools requested in support of special tasks from the Secretary of Defense, the Joint Chiefs of Staff, and the military departments to include support to the J-12 working group of the Joint Frequency Panel of the Military Communications Electronics Board and other government support. Analyses performed in support of Department of Defense component's operational and developmental systems are performed on a user reimbursement basis.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	7,051	7,764	8,089		Continuing	N/A

Changes between the FY 1985 Descriptive Summary and the FY 1986 request are as follows. The FY 1984 increase of $53 thousand was to cover the civilian pay raise in that year. The FY 1985 reduction of $900 thousand was a result of Congressional action. The FY 1986 decrease is due to DOD budgetary adjustments.

4. (U) OTHER APPPOPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Operation and Maintenance	4,396	4,334	4,529	4,783	Continuing	N/A

5. (U) RELATED ACTIVITIES: The Center performs electromagnetic analyses for major Department of Defense communication-electronics systems. These system analysis projects are funded by reimbursements from users. These reimbursed funds are estimated to be $29.2 million in FY 1985, $30.7 million in FY 1986, and $32.3 million in FY 1987.

The Electromagnetic Compatibility Analysis Center (ECAC) is a unique effort that is not duplicated by other like projects. The Center exchanges data, math models, and computer programs with other agencies involved in frequency management such as the Department of Commerce, Interdepartment Radio Advisory Committee, and the National Telecommunications and Information Administration.

6. (U) WORK PERFORMED BY: The Electromagnetic Compatibility Analysis Center is located in Annapolis, MD. The contracting responsibility is performed by Headquarters, Air Force Systems Command through the Electronic Systems Division, Hanscom Air Force Base, MA. The current support contractor is the IIT Research Institute, Chicago, IL.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 33144F, Electromagnetic Compatibility Analysis Center.

A. (U) Project Description: The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense (DOD) facility established to provide advice and assistance on electromagnetic compatibility (freedom from radio interference) problems to the Secretary of Defense, Joint Chiefs of Staff, the military departments, and other DOD components. The Center is managed by the Air Force and available to all DOD users. The chairman of the Joint Chiefs of Staff and the Assistant Secretary of Defense for Communications, Command, Control and Intelligence jointly provide policy guidance, assign projects, and establish project priorities. The Air Force acts as executive agent for the facility to plan and budget for its operation. The Center consists of an Air Force Commander, Deputies for Army, Navy, Marine Corps, Air Force, and Special Projects, and an in-house technical management staff assisted by a contractor. The Center's primary function is the analysis of inter-system and system-to-environment electromagnetic systems to determine how they will operate in current and projected electromagnetic environments. Other analyses performed are those on frequency allocations and assignments in support of the frequency management in the military departments and the unified and specified commands. To perform the required analyses, the Center maintains and develops basic analysis techniques including models, prediction analysis systems, and special techniques. In addition to the analysis techniques, the Center maintains and develops extensive environmental data files that include information on the location and operating characteristics of United States and friendly-foreign equipment and systems, the equipment complements of specific vehicles or platforms (ship, army units, aircraft, etc.), the allocation and use of the frequency spectrum and all associated United States and international rules and regulations, digitized topographic data (United States and other nations), and future communications-electronic (C-E) equipments and subsystems in development or conceptual stages. The Center also provides the necessary facilities to perform its mission. The Research, Development, Test and Evaluation (3600) funds primarily provide for development and maintenance of the analytical capabilities, development of additional data base requirements, and government support. The Operation and Maintenance funds (3400) primarily support operational analysis projects of the military services and data base maintenance.

B. (U) Program Accomplishments and Future Efforts: The program element funding provided the operation, maintenance and administration, updating of data, and the continued development of electromagnetic capability analysis. Timely short term responses to operational problems from Southeast Asia, Europe, and the Continental United States were provided. Frequency assignment analyses have been continuous. Analyses of equipment, proposed or in research and development, have been documented in the technical reports.

(1) (U) FY 1984 Accomplishments: Research, Development, Test and Evaluation (RDT&E) funding provided continued data base and Frequency Records Resource System development and the expansion of analytical model capabilities. The majority of analysis projects, for both defense and non-defense activities, are financially supported by those activities through reimbursement. In FY 1984 more than 300 separate projects for the Army, Navy, Marine Corps, and Air Force were supported. In addition, approximately 70 other Department of Defense (DOD), joint agency, and other projects were addressed by the Electromagnetic Compatibility Analysis Center (ECAC). Examples of systems being analyzed and organizations supported are: Air Force E-3A and E-4 aircraft, Joint Tactical Information Distribution System (JTIDS), Air Force Strategic Satellite System and Global Positioning System, Combat Identification System; Army-Communications Electronics Engineering & Installation Agency, Army Tactical Field Engineering System, Single Channel Ground and Airborne Radio Subsystem, Position Location and Reporting System; Navy JTIDS, Surface Missile System AEGIS and PHALANX; and Marine Corps tactical communication electromagnetic compatibility analysis and operational support. Efforts of mutual concern to the Department of Defense and Federal Agencies (i.e., Federal Communication, Federal Aviation Administration) included projects such as the Microwave Landing System, North Atlantic Treaty Organization (NATO) Ultra High Frequency Air-Ground-Air Frequency assignment system, and communications and control systems. FY 1984 work is a continuation of efforts and studies started in FY 1983 by the various services. Core work in FY 1984 supported DOD and Joint Chiefs of Staff projects such as NATO Tactical Vulnerability, Space Wave, and High Frequency Propagations.

(2) (U) FY 1985 Program: The FY 1985 program will be similar in content to the efforts described above. It is anticipated that as systems become more complex and the number of frequency spectrum users grow, the interference problems and requests for analysis and data will increase. The level of effort expended on work directly funded under this program will be held approximately constant while the amount of user reimbursement work is expected to grow about two percent. Work to refine the electromagnetic compatibility data base for space systems to support existing and future space systems will be delayed to FY 1986 as a result of funding limitations generated during FY 1985 budget deliberations. A new support contract will be competed and negotiated for support through FY 1987 with two one-year options.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The requirement for electromagnetic analysis is increasing because of the growing number and complexity of communications electromagnetic systems. This program will develop and maintain improved analytical tools and data bases and make these capabilities available to all Department of Defense users. The center will undertake an effort to upgrade the electromagnetic data base and

analysis math models to address space systems and dynamic operational scenarios of conventional weapon systems throughout the world. Examples of the wide variety of systems which will be supported on a reimbursable basis in FY 1986 include the Single Channel Ground and Airborne Radio Subsystem, Army Tactical Field Engineering System, Joint Electronic Warfare Center, Joint Tactical Information Distribution System, Worldwide Airborne Command Post E-4B Aircraft and FAA Weather Radar. In addition, core funds of this program will support the Secretary of Defense and Joint Chiefs of Staff in spectrum allocation/assignment and special electromagnetic compatibility analysis projects. The estimated costs are based on past program experience, adjustments for expected cost growth, and projected workload to support the above projects.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33401F
DOD Mission Area: #380 - Communications Security (COMSEC)

Title: Communications Security
Budget Activity: #5 - Intelligence and Communications

1. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1,527	1,447	[	]	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force R&D portion of the overall DOD COMSEC program addresses problems encountered in adapting general purpose cryptographic equipment for use in new Air Force communication systems. The efforts are primarily directed at insuring that all systems being developed by the Air Force meet current national communication security requirements. The program develops ancillary systems such as voice digitizers and COMSEC equipment adapter units. Also, with National Security Agency (NSA) development authority, integrated COMSEC systems to meet specific Air Force Command, Control, Communications, and Intelligence (C3I) requirements are developed.

3. COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,527	1,447	[ ]		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The NSA is the overall manager of communications security equipment research and development under the policy guidance of the Assistant Secretary of Defense C3I. The other Services perform efforts under common Program Element #33401. This R&D program is coordinated and reviewed in the COMSEC Resources Program (CRP). The Air Force Electronic Security Command (ESC) performs COMSEC testing on equipment proposed for operational use in the USAF and also recommends the application of cryptographic equipment to operational commands.

6. (U) WORK PERFORMED BY: All research and development tasks under this program are managed through the Rome Air Development Center (RADC) of the Air Force Systems Command (AFSC). Contractors are: Lincoln Laboratory, Bedford, MA. (digital speech research); Arcon Corp., Bedford, MA. (math analysis and software development for in-house activities); and BDM Inc., Silver Springs, Md. (piezo-electric antennas).

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 33401F, Communications Security

Program Element: #33401F
DOD Mission Area: #380 - Communications Security (COMSEC)

Title: Communications Security
Budget Activity: #5 - Intelligence and Communications

A. (U) Project Description: The project implements specific R&D task requirements and schedules using in-house resources supplemented by development contracts. Products are transitioned to Electronic Systems Command (ESC), Air Force Systems Command (AFSC), Electronic Systems Division (ESD), and National Security Agency (NSA). Tasks within this project are: 01, TEMPEST R&D; 02, COMSEC Technology; 03, Secure Voice.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Upgraded ESC's TEMPEST data acquisition systems with automatically tuneable receivers. Development was completed on the optical modulator to be used as a TEMPEST probe. Development began on a piezo-electro based, electro-optic antenna and optical correlator for TEMPEST testing. An ultra compact voice coder was demonstrated and the technology was transferred to ESC. FY 1984 efforts included use of a newly instrumented in-house facility to begin development of improved secure voice test procedures. FY 1984 program began the analysis of data to determine the complex interrelationships between aircraft acoustic noise and quality secure voice systems.

(2) (U) FY 1985 Program: This program will continue development of electro-optic antenna technology and provide sufficient quantities for Operational Test and Evaluation by ESC as an improved TEMPEST measurement system. Optic correlator development will continue with integration of new antennas to form an electro-optic TEMPEST test system. FY 1985 development will improve current manpower intensive, time consuming TEMPEST testing methods. The 1985 efforts will also develop demonstration technology and specifications to support Air Force acquisition and installation of secure voice systems in the 1985-90 period based on the evaluation of algorithms, noise studies, hardware architectural studies and DOD Digital Voice Consortium research and development program results. Development will begin on next generation secure voice systems using time and frequency based signal processing research now being conducted, as well as results from parallel processing development from Very High Speed Integrated Circuits (VHSIC) programs.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 program will complete development of piezo-electric TEMPEST probes and continue development of an electro-optic correlator for the Automated TEMPEST Analysis System. In-house studies and analysis will be completed and procurement plans prepared for an FY 1987 development of a Missile Electronic Encryption Device (MEED). Technical support will be provided to the Digital Voice Consortium. In-house development will begin for integrating different secure voice systems based on prior work in both time and frequency domain signal processing research. Algorithm research for next generation secure voice systems will be completed.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Electro-optic TEMPEST Instrumentation	September 1986
(2) (U) 12.5KHz Digital Voice system	December 1986

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

PE #: 33401F

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35114F
DOD Mission Area: #357 - Navigation and Position Fixing

Title: Traffic Control/Approach/Landing Systems (TRACALS)
Budget Activity: #5 - Intelligence & Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		6,095	10,370	29,517	62,157	Continuing	N/A
2026	System Support	800	370	280	289	Continuing	N/A
2610	Berlin Long Range Radar (Note: German Govt. funded)						
2681	GPN-22 Electronic Counter Counter Measures (ECCM)	2,574					2,574
2759	Microwave Landing System	2,721	5,500	7,803	26,087	80,093	122,204
2966	Rapidly Deployable Air Traffic Control System	0	2,000	19,945	28,675	13,214	63,834
2967	Air Traffic Control Survivability	0	2,200	1,289	5,350	7,455	16,294
3040	Flight Inspection Aircraft	0	0	0	1,356	1,000	2,356
3042	BAMBOO TREE	0	300	200	400	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the Air Force with the Air Traffic Control and Landing equipment required for safe, efficient, worldwide, all weather Air Force flying operations. The mission need is to provide take-off, enroute and landing guidance and surveillance in order to meet wartime sortie requirements. In peacetime, the need is to support training, logistics and other operational flying with maximum safety.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,075	11,766	25,825		Continuing	N/A
Other Procurement	0	3,614	5,978		Continuing	N/A
Aircraft Procurement	300	0	0		Continuing	N/A

EXPLANATION: (U) Independent cost estimates for Tactical Microwave Landing System (TMLS) ground equipment and associated commercial avionics, the Flight Check Aircraft Replacement Program, and elements of the Air Traffic Control (ATC) Survivability Program were developed in FY 1984. The TRACALS funding request has been adjusted based on these updated cost estimates.

Program Element: #35114F — Title: Traffic Control/Approach/Landing Systems (TRACALS)

DOD Mission Area: #357 - Navigation and Position Fixing — Budget Activity: #5 - Intelligence & Communications

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement:	0	3,614	4,112	27,291	Continuing	N/A
2681 GPN-22 ECCM						
Funds		3,614				3,614
Quantities		1				1
2759 Microwave Landing System (MLS)						
Ground Equipment						
Funds				4,300	286,997	291,297
Quantities						
Fixed Base MLS				6	185	191
Tactical MLS					128	128
Main Operating Base/Bare Base MLS					90	90
2966 Rapidly Deployable ATC System						
Funds					553,074	553,074
Quantities						24
2967 ATC Survivability						
Funds			4,112	23,643	58,973	86,728
Quantities						
ECCM Mods					12	12
Tower Restoral Vehicle				19		19
Surveillance Restoral Vehicle				10	8	18
TRN-41 Antennas			40			40

Program Element: #35114F
DOD Mission Area: #357 - Navigation and Position Fixing

Title: Traffic Control/Approach/Landing Systems (TRACALS)
Budget Activity: #5 - Intelligence & Communications

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
3042 BAMBOO TREE					8,260	8,260
Funds						
Quantities		Not applicable				
Aircraft Procurement:		23,000		33,100	Continuing	N/A
3040 Flight Inspection Aircraft						
Funds		23,000		28,800	190,900	242,700
Quantities		Not applicable				
2759 Microwave Landing System						
Funds				4,300[1]	675,700[2]	680,000[2]
Quantities						
Commercial Equipage				80	2,720	2,800
Military Standard Equipage					5,500	5,500
2681 AN/GPN-22 Electronic Counter Counter Measures (ECCM) Passive Reflectors						
Funds						300
Quantities						36
Funds from Federal Republic of Germany for Berlin Radar Project 2610[3]	(15,100)	(12,000)	(8,000)	(4,800)		(65,100)

Footnotes: 1. These funds are in PE 41115F (C-130s). 2. These figures represent completion of Microwave Landing System (MLS) equipage for the entire Air Force fleet. These funds to be programmed in Weapon System PEs as implementation proceeds. 3. These figures are not included in the Air Force totals.

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5. (U) RELATED ACTIVITIES: Fixed Base Microwave Landing System (MLS) ground equipment will be acquired under Federal Aviation Administration (FAA) contract. The Navy's Multimode Receiver (PE 64504N) may have application to the Air Force's need for MLS fighter avionics. The Global Positioning System (GPS) (PE 35164F) will be investigated as an alternative to precision distance measuring equipment for MLS avionics installation. If GPS can be used for this function, considerable savings in avionics acquisition costs will be realized.

6. (U) WORK PERFORMED BY: Air Force Systems Command (AFSC) Electronic Systems Division, Hanscom AFB, MA, manages the overall TRACALS effort. Aeronautical Systems Division, Wright Patterson AFB, OH, manages the military standard MLS effort. Sanders Associates, Inc., Nashua, NH - Phase 3 Berlin Radar Program (Project 2610); General Electric Company, Fairfield, CT Phase 2 Berlin Radar Program (Project 2610); Raytheon Company, Sudbury, MA - AN/GPN-22 Electronic Counter Counter Measures (ECCM) (Project 2681); AIL, Farmingdale, NY - Phase 1 Berlin Radar Program (Project 2610); ARINC Research Corp., Annapolis, MD - System Support (Project 2026) and MLS (Project 2759); Mitre Corp., Bedford, MA - System Support (Project 2026) and MLS (Project 2759).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2026 System Support. This project provides planning support to all Traffic Control and Landing System acquisition projects managed by Air Force Systems Command, including several joint efforts with the Federal Aviation Administration (FAA) which have no Air Force RDT&E funding. The project funds study contracts supporting program costing and definition efforts. FY 1984 efforts defined program requirements for the FY 1985 Rapidly Deployable Air Traffic Control System and Air Traffic Control Survivability. The 1984 program also supported preparations for procurement of a new Tower Radar Display and Flight Data Entry/Printout Equipment. This was developed to be a joint procurement with the Federal Aviation Administration. The equipment will be used by DOD activities to file flight plans with FAA centers. The Air Force is lead service for DOD participation in both of these acquisitions. FY 1984 effort will continue in FY 1985 and work will begin to define how Air Force Traffic Control facilities in the United States will interface with Federal Aviation Administration National Airspace System Plan initiatives. FY 1986 work will be essential to keep pace with new developments. New positioning/navigation aids such as GPS and the emerging FAA changes in the Air Traffic Control (ATC) structure will require support definition. The initial effort will mature in this phase to assure Air Force operational capability in the ATC environment. One example is the new aircraft airborne identification equipment called Mode S. Civil aviation will require it in the future. The Air Force use of Basic Mode S equipment requirements and interface with civil/military airspace control agencies will be addressed. This is a continuing program. The civil airspace control authority has an ongoing modernization effort. As plans mature, the Air Force must define and assure programs are initiated to keep pace. The system support project will enable continued operation in the new environment via new procedures and equipment where needed.

B. (U) Project: 2759, Microwave Landing System. This is a twenty year program to transition Air Force operations from use of Precision Approach Radar (PAR) and the Instrument Landing System (ILS) to the international standard Microwave Landing System (MLS) for all tactical and fixed base precision landing operations. Program objectives are: 1) provide for continued interoperability with civil landing systems; 2) remove the military limitations of Precision Approach Radar (limited mobility, high manpower cost, site sensitivity) and ILS (vulnerability, no mobility, siting problems); 3) provide a new capability for precision landing operations into austere airstrips; and 4) assure continued landing system

interoperability with NATO which has agreed to transition to Microwave Landing System (MLS). By the year 2000, all Air Force bases and aircraft are to be equipped with MLS ground equipment and receivers. Acquisition of both ground equipment and avionics will be paced to civil sector plans with most acquisition costs incurred in the 1988-1998 time frame. These objectives are pursued within four acquisition projects: 1) Tactical MLS (TMLS) and associated commercial avionics; 2) Fixed Base MLS (FBMLS); 3) Main Operating Base/Bare Base MLS (MOB/BB MLS); and, 4) Standard Military MLS avionics. In Fiscal Year 1984 the DOD MLS Implementation Plan was updated. An independent cost estimate for TMLS and associated commercial avionics was completed. TMLS Request for Proposal (RFP) documentation was completed. The Military Airlift Command (MAC) System Operational Concept (SOC) for TMLS was validated, and the Air Force Communications Command TMLS SOC was drafted. The MLS Ground Implementation Plan was drafted. Memoranda of Understanding (MOAs) were drafted between DOD and FAA for FBMLS, the Air Force and the Army for TMLS and FBMLS, and the AF and the Navy for FBMLS and Multi-Mode Receiver activities. The Air Force initiated MLS avionics alternatives studies. Commercial avionics alternatives were investigated. Planning efforts for FBMLS were initiated. In Fiscal Year 1985 the TMLS RFP will be issued. Avionics studies and preparation for DOD review will continue. Commercial avionics efforts will continue. A joint AF/FAA Terminal Instrument Procedures (TERPS) test will be supported. MOB/BB MLS alternatives will be evaluated. A final MLS Ground Implementation Plan is scheduled. In Fiscal Year 1986 the DOD will review MLS avionics alternatives. A decision will be made on the MOB/BB MLS approach. DOD/FAA FBMLS planning will be finalized. FY 1986 funds provide for activities critical to the success of all aspects of the MLS program, both ground and airborne subsystems. As this program continues into Fiscal Year 1987 and beyond, FBMLS, TMLS, and MOB/BB MLS equipment will be procured. Commercial and military standard MLS avionics will be acquired for the Air Force fleet by the year 2000.

C. (U) Project: 2967, Air Traffic Control Survivability. This program is designed to increase the survival prospects of fixed base air traffic control facilities and services in Europe and Korea. Project activities retrofit AN/GPN-20 radars with an anti-jam capability, including anti-jam communications (HAVE QUICK) and a quick restoral Tactical Air Navigation (TACAN). The project is integrated with the Aircraft Surge Launch and Recovery (ASLAR) procedures recently implemented to increase wartime sortie rates and Air Base Survivability. These programs provide for short range air defense, runway repair and the use of alternate recovery surfaces. Development and acquisition resources requested in this program element will provide capabilities to advise short range air defense forces of friendly aircraft arrivals. With the Global Positioning System and Microwave Landing System capabilities, it will also provide minimum air traffic control, navigation and landing services at alternate landing areas. All restoration equipment acquired under this project is designed to provide the absolute minimum capability necessary. Operations will remain at reduced sortie rates after battle damage to fixed facilities until the fixed facility can be restored. Specific development and acquisition efforts are:

(U) Tower Restoral Vehicle (TRV) for Visual Flight Rules (VFR) and terminal area Air Traffic Management. Nineteen of these assets will be acquired for main operating bases in Europe and Korea using FY 1986/87 Other Procurement funds. The system will consist of a small shelter with windows on a four-wheel drive vehicle. It will have two Very High Frequency (VHF) and two Ultra High Frequency (UHF) HAVE QUICK radios and inexpensive weather sensors. It will transport the AN/TRN-41 restoral TACAN. The vehicle will be kept in a low threat area on, or near, an airbase until the control tower or runway is out of operation. It will then be deployed to provide continuing service to whatever operating surface is being used to generate sorties.

(U) Surveillance Restoral Vehicle for Instrument Flight Rules (IFR) all weather recovery and air traffic management. The Surveillance Restoral Vehicle (SRV) will consist of a four-wheel drive vehicle with an enclosure containing a beacon sensor, the same radio complement as the Tower Restoral Vehicle (TRV), and two displays to portray beacon/IFF returns. The SRV will be capable of providing beacon sensor data to the semihardened operation shelter for any surviving fixed base radar independent operation on or off the air base. Its operations concept is the same as the TRV. In Fiscal Year 1985, the project was initiated and effort will center on RDT&E for the AN/GPN-20 Air Traffic Control (ATC) radar Electronic Counter Counter Measures (ECCM), the Tower Restoral Vehicle and the Surveillance Restoral Vehicle. Procurement of Tactical Air Navigation (TACAN) monitor and antenna components for survivability is planned for Fiscal Year 1986. This will include the initial spares. FY 1986 has $1.741M RDT&E to complete development of the tower and surveillance restoral vehicles. Production is planned for FY 87 to meet FY 87-89 operational capability.

Project: 3042, BAMBOO TREE. BAMBOO TREE is the nickname for Air Force efforts to assure that the United States can fly the Berlin corridors in the event of

The Berlin radar was installed and became operational in Fiscal Year 1984. The United States in Fiscal Year 1985. After successful completion of testing, the second AN/GPN-22 ECCM Mod Kit will be procured. The Berlin radar automation program will progress in procurement and installation. Integration with existing communication capabilities and problem resolution will be supported. In conjunction with the programs, the Air Force will maintain a low key effort to monitor the threat and possible future countermeasures in Fiscal Year 1985. Since the programs previously funded will not be funded after FY 1984, this project has been programmed to provide continuing support to the BAMBOO TREE mission. A continued effort is essential to maintain analysis and capabilities in the Berlin threat environment. Efforts in Fiscal Year 1986 will be directed toward defining an for procurement with funds programmed from FY 1987-89. No new radios will be developed but the developed under other programs.

8. (U) PROJECT OVER $10 MILLION IN FY 1986

Project: 2966, AN/MPN-XX

A. (U) Project Description: This project replaces 32 AN/MPN-14 mobile radar approach control facilities of 1950's vintage. It is designed for operation at forward airfields. It will also be C-130 transportable, rugged, designed for easy repair of battlefield damage and equipped to operate in the electronic combat environment. Existing radar/technology will be used. Development costs are centered on packaging equipment into DOD standard shelters, integration and first articles for testing with follow on use. The system will be modular in nature and designed to interface with fixed base AN/GPN-24 approach control facilities and deployed to main operating bases in Europe and Korea. This will make it possible to deploy subsystems for battle damage restoration as well as peacetime operations. This has the advantage of reducing airlift requirements.

Program Element: #35114F
DOD Mission Area: #357 - Navigation and Position Fixing

Title: Traffic Control/Approach/Landing Systems (TRACALS)
Budget Activity: #5 - Intelligence & Communications

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 84 Accomplishments: With discretionary funds outside this Program Element, the Air Force investigated additional acquisition of the AN/TPN-19 Air Traffic Control Radar; procurement of the surveillance and Precision Approach Radar (PAR) portions of the Marine Air Traffic Control and Landing System (MATCALS); and a major modification of the AN/MPN-14 radar van as alternatives to the AN/MPN-XX Rapidly Transportable Air Traffic Control System. A Program Requirements Summary was developed and discussions with industry were initiated.

(2) (U) FY 85 Program: Using the results of studies conducted in FY 1984, the Air Force proposed MPN-XX as a replacement program. Use of existing/upgraded systems will be re-evaluated prior to submission of the 1 March 1985 report required by Congress. FY 1985 efforts include planned award of a system development contract. Design development relates mainly to packaging of existing technology/radar equipment into DOD standard shelters.

(3) FY 86 Planned Program and Basis for FY 1986 RDT&E Request: The AN/MPN-14 will be logistically unsupportable in 1985 and can be continued until its replacement is available only by paying premium prices for replacement spares and quick-fix modifications. Aside from its age, The Air Force plans to phase out Precision Approach Radar (PAR) when Microwave Landing System (MLS) is fully implemented. Because of the large number of aircraft involved (8300+), the Air Force will not be fully MLS capable until about the year 2000. Consequently, the Air Force sees no realistic alternative to provide precision landing service at tactical air bases in the 1989-1998 time period except to acquire a PAR along with the other subsystems of the AN/MPN-XX which are required indefinitely. A fully adequate modernization of the A preproduction MPN-XX system will be assembled in FY 1986 for development and operational testing in FY 1987.

(4) (U) Program to Completion: A three year production run will commence in FY 88.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Complete AN/MPN-XX planning	FY 84
(2)	(U)	Initial AN/MPN-XX development	FY 85
(3)	(U)	Acquire AN/MPN-XX prototype	FY 86
(4)	(U)	AN/MPN-XX IOT&E	FY 87
(5)	(U)	AN/MPN-XX production decision	FY 87
(6)	(U)	AN/MPN-XX deliveries	FY 89-91

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35164F Title: Navstar Global Positioning System (GPS) (User Equipment)
DOD Mission Area: #357 - Navigation and Position Fixing Budget Activity: #5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		6,709	9,060	28,691	22,710	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element funds R&D to integrate Navstar GPS user equipment into approximately 11,000 Air Force airborne and ground platforms. It also funds production and installation of GPS equipment and their associated support. Military forces need precise location data to enhance command and control and to engage in strategic and tactical warfare. A global, common grid positioning and navigation system is required to increase both accuracy and the availability of current weapon systems, especially at night and in adverse weather, thus significantly increasing their effectiveness. GPS satellites will also carry the Nuclear Detonation (NUDET) Detection System (NDS) (also known as the Integrated Operational NUDET Detection System (IONDS)) as an additional payload to detect and locate nuclear detonations. The GPS Mission Element Need Statement was revalidated by the Secretary of Defense at Milestone II.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	6,709	9,060	22,900		Continuing	N/A
Aircraft Procurement	0	8,000	56,400		Continuing	N/A
Other Procurement	0	0	14,545		Continuing	N/A

Decrease in FY 1986 of $6.0 million in Other Procurement is due to reduced initial buy of GPS manpacks from 290 to 161. Increase in FY 1986 of $5.8 million in RDT&E and decrease of $7.7 million in aircraft procurement changes funding of integration software from procurement to RDT&E.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
Funds		8,000	48,700	122,600	Continuing	N/A
Quantities		0	42	337		
Other Procurement						
Funds			8,428	9,435	Continuing	N/A
Quantities			161	200		

5. (U) RELATED ACTIVITIES: The GPS development and operational implementation is a joint program. Supporting activities of the Army, Navy, Air Force, Marine Corps, Defense Mapping Agency, Department of Transportation and North Atlantic Treaty Organization are coordinated through the Joint Program Office. Use of the Global Positioning System to provide guidance corrections for tactical missiles is being separately explored under Program Element 63601F, Conventional Weapons Technology. Investigation of advanced anti-jamming technology is conducted under Program Element 63202F, Advanced Avionics for Aircraft. GPS also support the Navy's Fleet Ballistic Missile Programs (Program Element 11221N, Fleet Ballistic Missile Systems) by providing test range positioning instrumentation.

(U) The North Atlantic Treaty Organization Global Positioning System Project is a cooperative venture between the United States and nine NATO nations. This project provides information to these nations to assist them in making decisions about adopting the system for military forces.

(U) Full Scale Development of user equipment was funded by all services under Program Elements 64777N and 64778A/F, Navstar Global Positioning System for the Navy, Army and Air Force, respectively. The Air Force also funded satellite development and ground control segment development/deployment in Program Element 64778F. The Navy funds the development of clock technology used by both the satellite and control segment in PE 64777N. Integration of user equipment into Army and Navy platforms (subsurface, surface and airborne) is funded in PE 64778A and PE 64777N, respectively. Procurement funding for Army and Navy equipments is in PE 35164A/N and specific aircraft and ship program elements.

(U) The Nuclear Detonation (NUDET) to Detection System (NDS) payload (also known as the Integrated Operational NUDET Detection System (IONDS)) was flown on Navstars 8, 9 and 10. NDS will be flown on the remaining GPS development satellite (Navstar 11) and on all operational satellites. Program Elements 31357F and 12433F, Nuclear Detonation Detection System, fund NDS payloads. Expendable launch services (Atlas E/F) are funded under Program Element 35119F, Space Boosters. Space Shuttle launches and Payload Assist Module Delta Class (PAM-DII) upper stages are funded under Program Element 35171F, Space Launch Support. The Consolidated Space Operations Center is funded under Program Element 35130F.

6. (U) WORK PERFORMED BY: The Joint Program Office is located at the Air Force Systems Command's Space Division, Los Angeles AFS, CA. The satellite contractor is Rockwell International/Space Operations and Satellite Systems Division, Seal Beach, CA. International Telephone and Telegraph, Nutley, NJ and Rockwell International/Autonetics Strategic Systems Division, Anaheim, CA, are the subcontractors for the navigation subsystems. Aerospace Corp., El Segundo, CA, provides technical and engineering support. There is a competitive User Equipment development effort between Magnavox Advanced Products and Systems Co., Torrance, CA and Rockwell International/Collins Government Avionics Div., Cedar Rapids, IA. Intermetrics, Cambridge, MA is the user equipment software independent verification/validation contractor. Operational Control Segment development/deployment is being done by International Business Machines/Federal

Systems Div., Gaithersburg, MD. Logicon, Long Beach, AC; Kern Co., Danvers, MA; Frequency Electronics, New Hyde Park, NY and Frequency and Time Systems, Inc., Beverly, MA are participating in the clock technology development under the Naval Research Laboratory, Washington, DC. The Naval Air Development Center, Warminster, PA, the Naval Avionics Center, Indianapolis, IN, and the Army Avionics Research and Development Activity, Ft Monmouth, NJ, are providing technical and validation support to the program office for joint service user equipment development.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35164F, Navstar Global Positioning System

A. (U) Project Description: The Navstar Global Positioning System (GPS) is a spaced-based radio positioning and navigation system designed to provide worldwide, all weather, three-dimensional position (16 meter Spherical Error Probable), velocity (0.1 meter/sec) and precise time (within 0.1 microsecond). GPS provides a common navigation grid for land, air and sea units for coordinated operations. GPS improves our strategic target mapping capability, the probability of target acquisition, flexible routing, low-level ingress/egress, and the accuracy of delivered weapons. These features, along with a capability for highly accurate passive operations, enhance the force effectiveness and survivability of many U.S. weapon systems.

(U) GPS consists of three segments. The space segment produces the worldwide navigation signals. It consists of the 18 satellite constellation plus three on orbit spares. The control segment consists of five Monitor Stations and three ground antennas (located around the world) and a Master Control Station (MCS), which will be a tenant in the Consolidated Space Operations Center. The Monitor Stations measure satellite performance parameters which are evaluated and corrected by the MCS and then forwarded to the satellites by the ground antennas. The user segment consists of the avionics and interfaces necessary to receive and process GPS satellite signals into position, velocity, and time data for various military users. This project develops the capability to integrate GPS user equipment into Air Force System.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: User equipment testing continued with preproduction user equipment from both competitors on Phase II host vehicles. The Air Force test vehicles are the F-16 and the B-52G. Development of software and hardware interfaces for operational F-16, RC-135 and B-52G aircraft began.

(2) (U) FY 1985 Program: PE 64778F will fund completion of the Air Force portion of the user equipment development in eight joint service platforms. Research, Development, Test and Evaluation funds in PE 35164F will complete development of the B-52G integration kit, continue development of integration hardware and software for the F-16 and fund integration studies for future GPS aircraft modifications. A production decision is planned for late 1985.

The FY 1985 aircraft procurement funds will be used to initiate user avionics tooling and installation engineering to install GPS on F-16s. Cost estimates are based on parametric evaluation of the costs to perform the R&D effort. A DOD level review of the GPS cost estimate was last completed in November 1982.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: RDT&E funds will support user equipment integration into the F-15E; E-3A; F-111 A, D, E and F; B-52G and RC-135. These efforts include GPS vehicle integration, interface control working group activities, system integration lab testing, prototypes, technical support and maintenance. The other major R&D effort is the development of a common GPS equipment interface in order to avoid development of a unique interface for each aircraft integration. Cost estimates for these efforts are based on a grassroots analysis conducted in the summer of 1984. The estimate assumes selection of a single contractor from the two competitors for user equipment, and reasonable negotiations with the aircraft integrating contractors.

(4) (U) Program to Completion: This is continuing program. Integration of GPS user equipment into approximately 11,000 Air Force airborne and ground platforms will continue through 1998.

C. (U) Major Milestones:

	Milestones		Dates
(1) (U)	Defense Systems Acquisition Review Council (DSARC) II (PE 64778F)		3 Q FY 79
(2) (U)	Begin Satellite Production (PE 35165F)		4 Q FY 82
(3) (U)	Begin User Avionics Initial Operational Test and Evaluation (IOT&E) (PE 64778F)	*(2Q FY 84)	4 Q FY 84
(4) (U)	Defense Systems Acquisition Review Council III (PE 64778F)	*(3Q FY 85)	1 Q FY 86
(5) (U)	Begin User Avionics Limited Production (PE 35164F)	*(2Q FY 85)	1 Q FY 86
(6) (U)	Shuttle Launch First Satellite (PE 35165F)	*(4Q FY 86)	1 Q FY 87
(7) (U)	Achieve Worldwide 2-D Capability (PE 35165F)	*(3Q FY 87)	4 Q FY 87
(8) (U)	Achieve Worldwide 3-D Capability (PE 35165F)		1 Q FY 89

* Date Presented in Fiscal Year 1985 Descriptive Summaries.

(U) EXPLANATION OF MILESTONE CHANGES

(3&4) (U) User avionics IOT&E and DSARC slipped two quarters to allow correction of software deficiencies.
(5) (U) Previously reported date was for limited production which is no longer contemplated.
(6&7) (U) Reflects minor changes in shuttle launch availability to support GPS missions.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35165F Title: Navstar Global Positioning System (GPS) (Space/Ground Segments)

DOD Mission Area: #357 - Navigation and Position Fixing Budget Activity: #5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		25,243	33,464	48,527	24,139	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element funds R&D to integrate GPS user equipment into approximately 11,000 Air Force airborne and ground platforms. It also funds production and installation of GPS equipment and their associated support. Military forces need precise location data to enhance command and control and to engage in strategic and tactical warfare. A global, common grid positioning and navigation system is required to increase both accuracy and the availability of current weapon systems, especially at night and in adverse weather, thus significantly increasing their effectiveness. GPS satellites will also carry the Nuclear Detonation (NUDET) Detection System (NDS) (also known as Integrated Operational NUDET Detection System (IONDS)) as an additional payload to detect and locate nuclear detonations. The GPS Mission Element Need Statement was revalidated by the Secretary of Defense at Milestone II.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	25,243	33,464	57,005		Continuing	N/A
Missile Procurement	256,113	332,278	227,180		Continuing	N/A

Decrease in FY 1986 of $8.5M in RDT&E and $29.8M in Missile Procurement is due to deletion of requirement for crosslink ranging to improve GPS survivability.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Missile Procurement:						
Funds	256,090	331,914	197,398	172,778	Continuing	N/A
Order Qty/Full Fund	0/1	0/6	0/9	16/8		

Program Element: #35165F

Title: Navstar Global Positioning System (GPS) (Space/Ground Segments)

DOD Mission Area: #357 - Navigation and Position Fixing

Budget Activity: #5 - Intelligence and Communications

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	Military Construction Funds	7,300					7,300

5. (U) RELATED ACTIVITIES: The GPS development and operational implementation is a joint program. Supporting activities of the Army, Navy, Air Force, Marine Corps, Defense Mapping Agency, Department of Transportation and North Atlantic Treaty Organization are coordinated through the Joint Program Office. Use of the Global Positioning System to provide guidance corrections for tactical missiles is being separately explored under Program Element 63601F, Conventional Weapons Technology. Investigation of advanced anti-jamming technology is conducted under Program Element 63202F, Advanced Avionics for Aircraft. GPS also support the Navy's Fleet Ballistic Missile Programs (Program Element 11221N, Fleet Ballistic Missile Systems) by providing test range positioning instrumentation.

(U) The North Atlantic Treaty Organization Global Positioning System Project, a cooperative venture between the United States and nine other nations, provides information to these nations to assist in making decisions about adopting the system for military forces.

(U) Full Scale Development of user equipment was funded by all services under Program Elements 64777N and 64778A/F, Navstar Tlobal Positioning System for the Navy, Army and Air Force, respectively. The Air Force also funded satellite development and ground control segment development/deployment in Program Element 64778F. The Navy funds the development of clock technology used by both the satellite and control segment in PE 64777N. RDT&E and procurement funds to integrate GPS avionics into Air Force ground and airborne platforms are in PE 35164F, Navstar GPS User Equipment and specific aircraft program elements. Integration of user equipment into Army and Navy platforms (subsurface, surface, and airborne) is funded in PE 64778A and PE 64777N respectively. Procurement funding for Army and Navy equipment is in PE 35164A/N and specific aircraft and ship program elements.

(U) The Nuclear Detonation (NUDET) Detection System (NDS) (also known as Integrated Operational NUDET Detection System (IONDS) payload was flown on Navstars 8, 9 and 10. NDS will be flown on the remaining GPS development satellite (Navstar 11) and on all operational satellites. Program Elements 31357F and 12433F, Nuclear Detonation Detection System, fund NDS payloads. Expendable launch services (Atlas E/F) are funded under Program Element 35119F, Space Boosters. Space Shuttle launches and Payload Assist Module (PAM) upper stages are funded under Program Element 35171F, Space Launch Support. The Consolidated Space Operations Center which will host the operational GPS Master Control Station is funded under Program Element 35130F.

Program Element: #35165F Title: Navstar Global Positioning System (GPS) (Space/Ground Segments)

DOD Mission Area: #357 - Navigation and Position Fixing Budget Activity: #5 - Intelligence and Communications

6. (U) WORK PERFORMED BY: The Joint Program Office is located at the Air Force Systems Command's Space Division, Los Angeles (AFS) Air Force Station CA. The satellite contractor is Rockwell International/Space Operations and Satellite Systems Division, Seal Beach, CA. International Telephone and Telegraph, Nutley, NJ and Rockwell International/Autonetics Strategic Systems Division, Anaheim, CA, are the subcontractors for the navigation subsystems. Aerospace Corp., El Segundo, CA, provides technical and engineering support. There is a competitive User Equipment development effort between Magnavox Advanced Products and Systems Co., Torrance, CA and Rockwell International/Collins Government Avionics Div., Cedar Rapids, IA. Intermetrics, Cambridge, MA is the user equipment software independent verification/validation contractor. Operational Control Segment development/deployment is being done by International Business Machines/Federal Systems Div., Gaithersburg, MD. Logicon, Long Beach, CA; Kern Co., Danvers, MA; Frequency Electronics, New Hyde Park, NY and Frequency and Time Systems, Inc., Beverly, MA are participating in the clock technology development under the Naval Research Laboratory, Washington, DC. The Naval Air Development Center, Warminster, PA; the Naval Avionics Center, Indianapolis, IN; and the Army Avionics Research and Development Activity, Ft Monmouth, NJ, are providing technical and validation support to the program office for joint service user equipment development.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35165F, Navstar Global Positioning System (Space/Ground Segments)

A. (U) Project Description: The Navstar Global Positioning System (GPS) is a spaced-based radio positioning and navigation system designed to provide worldwide, all weather, three-dimensional position (16 meter Spherical Error Probable), velocity (0.1 meter/sec) and precise time (within 0.1 microsecond). GPS provides a common navigation grid for land, air and sea units for coordinated operations. GPS improves our strategic target mapping capability, the probability of target acquisition, flexible routing, low-level ingress/ egress, and the accuracy of delivered weapons. These features, along with a capability for highly accurate passive operations, enhance the force effectiveness and survivability of many US weapon systems.

(U) GPS consists of three segments. The space segment produces the worldwide navigation signals. It consists of the 18 satellite constellation plus three on orbit spares. The control segment consists of five Monitor Stations and three ground antennas (located around the world) and a Master Control Station (MCS), which will be a tenant in the Consolidated Space Operations Center. The Monitor Stations measure satellite performance parameters which are evaluated and corrected by the MCS and then forwarded to the satellites by the ground antennas. The user segment consists of the avionics and interfaces necessary to receive and process GPS satellite signals into position, velocity, and time data for various military users.

Program Element: #35165F Title: Navstar Global Positioning System (GPS) (Space/Ground Segments)

DOD Mission Area: #357 - Navigation and Position Fixing Budget Activity: #5 - Intelligence and Communications

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The 28 satellite multiyear Block Buy procured materials, parts, components, subsystems, labor and data in economic order quantities and full funded GPS satellites as follows: FY 1984 (1), FY 1985 (6), FY 1986 (9), FY 1987 (8), FY 1988 (4). Sites were developed for ground antennas and an existing building at Cape Canaveral was modified to provide a GPS satellite processing facility. RDT&E funds were also used to develop preplanned product improvements to enhance system survivability. These included additional satellite hardening, and limited satellite autonomy.

(2) (U) FY 1985 Program: The multiyear satellite production contract continues. The Joint Program Office will continue Pre-Planned Product Improvements to increase GPS survivability against more severe threats projected for the mid 1990's. Planned improvements include additional hardening against nuclear effects and 180 day autonomous satellite operation. The additional hardening and autonomy changes, which do not impact multiyear savings, are planned for 19 of the initial 28 satellites. Launch of the last R&D satellite is expected in mid-FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: All efforts initiated under PE 64778F will be transferred to this Program Element. Operation will continue of the five satellite developmental GPS constellation to support testing of user equipmentand the Navy' Fleet Ballistic Missile Programs. Testing of the preproduction GPS satellite will be completed. Full scale development and deployment of the GPS operational ground control segment will continue. Transfer of the operational Master Control Station from Vandenberg AFB to the Consolidated Space Operations Center is planned. Cost estimates are based on negotiatd costs (for space, control, and user segment RDT&E) and extrapolation of existing costs to continue support of the R&D satellite constellation control segment and launch services. A DOD level review of the GPS space and control cost estimate was last completed in November 1982.

(4) (U) Program to Completion: This is a continuing program. Support for the R&D constellation will continue on a decreasing basis and end in FY 1988 when the operational GPS constellation is completed. The first launch of an operational spacecraft will be in late CY 1986. Control segment development, deployment and support will continue until FY 1987 when turnover to the system operator, Space Command, is planned. R&D [illegible]red to integrate GPS avionics into Air Force aircraft is funded in PE 35164F. The develepent of the baseline GPS [illegible]em will be complete in FY 1988. Starting in FY 1987, funds are programmed to develop a follow-on satellite to the Block II production satellites currently programmed. The plan is to compete this development.

Program Element: # 35165F Title: Navstar Global Position System (GPS) (Space/Ground Segments)

DOD Mission Area: #357 - Navigation and Position Fixing Budget Activity: #5 - Intelligence and Communications

C. (U) Major Milestones:

	Milestones		Dates
(1)	(U) Defense Systems Acquisition Review Council (DSARC II) (PE 64778F)		3 Q FY 79
(2)	(U) Begin Satellite Production (PE 35165F)		4 Q FY 82
(3)	(U) Begin User Avionics Initial Operational Test and Evaluation (IOT&E) (PE 64778F)	*(2Q FY 84)	4 Q FY 84
(4)	(U) Defense Systems Acquisition Review Council III (PE 64778F)	*(3Q FY 85)	1 Q FY 86
(5)	(U) Begin User Avionics Limited Production (PE 35164F)	*(2Q FY 85)	1 Q FY 86
(6)	(U) Shuttle Launch First Satellite (PE 35165F)	*(4Q FY 86)	1 Q FY 87
(7)	(U) Achieve Worldwide 2-D Capability (PE 35165F)	*(3Q FY 87)	4 Q FY 87
(8)	(U) Achieve Worldwide 3-D Capability (PE 35165F)		1 Q FY 89

* Date Presented in Fiscal Year 1985 Descriptive Summaries.

(U) EXPLANATION OF MILESTONE CHANGES

(3&4) (U) User avionics IOT&E and DSARC slipped two quarters to allow correction of software deficiencies.
(5) (U) Previously reported date was for limited production which is no longer contemplated.
(6&7) (U) Reflects minor changes in shuttle launch availability to support GPS missions.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #84733F
DOD Mission Area: #476 - Training, Medical and Other General Personnel

Title: General Intelligence Skill Training
Budget Activity: #5 - Intelligence and Communications

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,846	5,208	5,300	6,895	13,296	33,545
2909	SENTINEL ASPEN	2,846	5,208	5,300	6,895	13,296	33,545

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The current Air Force Intelligence Training program at the Armed Forces Air Intelligence Training Center (AFAITC) is not adequate to meet rapidly expanding national and technical requirements for skilled, highly qualified intelligence technicians to operate numerous, complex, high technology systems rapidly replacing traditional manpower intensive intelligence operations. The Air Force training system is a manpower intensive, manually oriented program not presently equipped to meet the requirements of a high technology operational world. AFAITC cannot currently prepare students to operate sophisticated systems, analyze an increasing volume of multi-source data and deal with real/near-real time high threat problems. To rectify this situation, action must be taken to create integrated training laboratories using automated techniques comparable to those in the field. This will reduce training overhead in operational on-the-job-training programs, while providing realistic, operationally applicable training in current intelligence collection, processing/analysis and exploitation techniques. Because of the number and cost of evolving intelligence systems, this training must stress "generic" functions and capabilities since cost of the end-item equipment will prevent acquisition of equipment for each system. Therefore, the training system must address and train as many of these "generic" functions as possible.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,846	7,208	7,517		31,429	49,000
Other Procurement	1,600	1,000	1,900		20,500	24,500

(U) The FY1985 decrease reflects a $2 million Congressional reduction. Other RDT&E changes reflect revised program requirements.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement	0	2,533	2,652	3,560	12,700	21,445
Operations and Maintenance	0	0	0	200	3,200	3,400

5. (U) RELATED ACTIVITIES: SENTINEL BRIGHT is a companion program to modernize cryptologic/signals intelligence (SIGINT) related skill training. RDT&E funds for SENTINEL BRIGHT are in program element 35885G, Tactical Cryptologic Program, Research and Development. Procurement funding for SENTINEL BRIGHT is in program element 84734F. Task 7 of SENTINEL BRIGHT (Fusion Training Module) has been absorbed by the SENTINEL ASPEN program to ensure the incorporation of the fusion training needs of both programs. In addition, program management direction for both programs specifies close coordination to ensure that commonality/compatibility of equipment and training delivery systems software is sought whenever economically and technically feasible.

6. (U) WORK PERFORMED BY: The program management office for SENTINEL ASPEN is the Intelligence Systems Directorate, Electronic Systems Division, Hanscom AFB, MA. Each phase of the program will be competitively bid. Phase I, General Imagery Intelligence Training System (GIITS), dual design contracts were awarded in October, 1983 to Ford Aerospace, Palo Alto, CA, and Goodyear Aerospace, Litchfield Park, Az. Full-scale development contract award will be February, 1985.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2909, SENTINEL ASPEN

A. (U) Project Description: SENTINEL ASPEN is a continuing project to upgrade and modernize the General Intelligence Training program to a point where it will have technical equivalence with late-1980s state-of-the-art and will provide a technical baseline to continue this equivalence into the 1990s. The program is a two-phased effort beginning with modernization of the imagery intelligence training program. Phase I will provide a digital (softcopy) imagery training program (currently nonexistent) and will modernize the traditional hardcopy training program by providing hands-on generic training in automated data manipulation and reporting techniques for which no current training exists. Phase II will provide generic training in techniques required for intelligence applications, analysis, indications and warning, fusion and target intelligence operations. Training for these functions either does not currently exist, or is done manually, and does not meet the stated requirements of the combat force.

Program Element: #84733F
DOD Mission Area: #476 - Training, Medical and Other General Personnel

Title: General Intelligence Skill Training
Budget Activity: #5 - Intelligence and Communications

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Dual design contractors have presented their designs for a General Imagery Intelligence Training System (GIITS) and contract award for development of one of these designs will be made in February 1985. The dual design resulted from a previously completed study of operational and developing imagery exploitation systems conducted in FY 1983. This study identified "generic" requirements for training from twelve different systems. These requirements were then included in the specification for the GIITS. In 1984 we initiated the study of systems to be supported by Phase II of SENTINEL ASPEN.

(2) (U) FY 1985 Program: In FY 1985 we anticipate award of the development contract for the GIITS. The selected contractor will proceed to integrate the workstations with the mainframe host. In addition, the contractor will develop a digital imagery training course (80 hours) and an automated hardcopy course (140 hours) to provide a computer assisted/managed instruction capability for the school. We will also continue definition of the requirements for Phase II.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 program continues the development effort begun in FY 1985 leading to a system initial operating capability in FY 1988. The effort in FY 1986 will continue the integration of equipment into a training system, as opposed to a mere collection of pieces of gear. The development of software and courseware for the actual training courses will also form a major portion of the development effort. More effort will be placed on Phase II of the program. The development of system specifications and initial development activity for Phase II will begin in FY 1986. The cost estimate was developed using grassroots estimates for hardware and software devlopment costs and parametric estimates for management and system engineering aspects of the program. The estimate is based on multiple year development and procurement using as much commercial-off-the-shelf equipment as possible.

(4) (U) Program to Completion: Full scale development and procurement of hardware to support Phase II should begin in FY 1987. Procurements and system integration effort on Phase I should continue into FY 1987 leading to an initial operational capability in FY 1988. Phase II IOC should be in FY 1990 with full operational capability in FY 1991/2.

C. (U) Major Milestones:

Milestones		Dates
(1) Contract award - Phase I	*(Sep84)	Dec 84
(2) Phase I IOC	*(Dec86)	Apr 88
(3) Development contract award - Phase II		Dec 86

* Date presented in Fiscal Year 1985 Descriptive summaries.

(4) Phase II IOC FY1990

(U) EXPLANATION OF MILESTONE CHANGES

(1) Contract award for Phase I slipped 3 months due to refinement to the specification.

(2) IOC of the Phase I system has slipped one year and four months due to decrements in the funding profile. Current estimate reflects most reasonable estimate based on funding profile.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63248F
DOD Mission Area: #553 - Engineering Technology (ATD)

Title: Concept Development
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		3,995	1,000	3,028	3,114	Continuing	NA

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The normal planning, programming, and budgeting system (PPBS) provides an effective method to transition technology through exploratory development into system acquisition. However, in a limited set of cases, (i.e., technological breakthrough, exploitation of enemy weaknesses, alternate use of existing technologies, etc.), the PPBS does not have the flexibility to capitalize on these opportunities on a timely basis. To address this problem, the Commander of Air Force Systems Command has established an office of New Concepts and Initiatives (NCI) to solicit innovative ideas from all sources and act as a clearing house to determine and implement appropriate actions. Working with using commands and Headquarters United States Air Force, the NCI office assesses the military worth of concepts and recommends one of the following dispositions: (1) rejection; (2) referral; (3) reorientation of existing programs; or (4) acceptance as an NCI for a feasibility demonstration. In the latter two cases, a modest amount of "out-of-hide" and/or appropriated funds are necessary to support these program formulation efforts and demonstrations. The Concept Development program element will underwrite these efforts particularly in cases when the new concepts cannot be specifically related/funded within ongoing efforts.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	495	2,479	3,095		Continuing	NA

(U) FY 1984: Funds appropriated were augmented by a $3.6 million within threshold reprogramming to conduct an NCI program commensurate with the originally envisioned level of $5.0 million/year (constant 83 dollars).

(U) FY 1985: This program element was reduced without prejudice. Below threshold reprogramming of $2.0 million is being evaluated to continue NCIs initiated in FY 1984 and to begin NCIs programmed for 1985.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Since the New Concepts and Initiatives (NCI) program is structured to capitalize on innovative concepts as they occur, it is strongly related to the entire range of technology activities including technology base efforts of the AF, other Services, Defense Advanced Research Projects Agency (DARPA), other Federal Agencies and contractor Independent Research and Development programs.

6. (U) WORK PERFORMED BY: Concept Action Teams are formed at Air Force Systems Command product divisions and laboratories, with participation of user commands, to review and manage NCIs in response to direction from the NCI office. Validation demonstrations are primarily contracted out and account for the bulk of the funds in the Concept Development program element. Currently, the top five contractors for FY 84 are: Hughes Aircraft (Conoga Park CA), IBM (Owego NY), GTE Sylvania (Los Angeles CA), General Electric (Valley Force PA) and Sierra Research (Buffalo NY). Reorienting/focusing efforts will generally be accomplished using in-house resources.

7 (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986: Most of the NCI efforts will be incremently funded over a one to three year span, usually at a total cost of less than $3 million. Specific initiatives currently in progress or programmed include the following, while provision for new activities will be maintained in response to emerging opportunities.

(U) Laser Communications Evaluation (HAVE LACE): The objective of this demonstration is to demonstrate secure covert air-to-air laser communications and recommend appropriate applications of it for transition to systems development. This is a joint Avionics Laboratory and NCI effort. Flight test of a prototype system will be conducted this fiscal year.

(U) Phased Integrated Laser Optics Technology (PILOT): This project is a proof-of-concept demonstration for an innovative/classified laser technology.

(U) Situational Awareness Terminal (HAVE VAIL): This project will demonstrate the feasibility of automatic stationkeeping equipment to enhance tactical operations in periods of low visibility. The project is an 18-month, $2.0 million effort initiated in December 1984 at the request of Headquarters Tactical Air Command. Part of the demonstration will include flight testing of the hardware at Nellis AFB NV.

(U) Other NCIs which arise during the year will be funded, as appropriate, from within resources appropriated for directly related programs or the Concept Development program element. Programs anticipated for initiation in FY 1985 that will have continuing funding requirements in FY 1986 are: Integrated Self-Protection, Passive Non-Cooperative Identification, Microwave Radiation, Tactical Electromagnetic Gun and Advanced Infrared Seeker. The flexibility to respond/fund a small number of carefully selected high payoff NCIs when they occur, as opposed to some years later when they can be budgeted for, is the essence of the NCI program. Special attention is being given to limiting use of this process to only those innovative concepts which warrant accelerated support--and to limit their support under the NCI process to key demonstrations, following which the successful concepts are expected to be supported under conventional programming processes.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63402F
DOD Mission Area: #410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	74,355	71,500	70,434	74,816	Continuing	N/A
2617	Free-Flyer Spacecraft Missions	49,136	18,503	22,334	45,716	Continuing	N/A
2618	Quick Response Shuttle Missions	0	0	2,000	2,510	Continuing	N/A
2619	Teal Ruby Mission	0	30,197	27,100	6,603	Continuing	N/A
2620	Shuttle Sortie Missions	25,219	22,800	19,000	19,987	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Space Test Program (STP) advances DOD technology by providing spaceflight missions for experiments that demonstrate new space system technologies, concepts, and designs; and for experiments that determine space environmental effects on DOD space systems. This tri-Service program provides the only substantial spaceflight capability to perform fly-before-buy demonstrations of advanced technology designs. The STP is the pathfinder for exploiting the Shuttle as a manned DOD space laboratory to expedite the infusion of new technology into space systems through the use of simpler, incrementally designed, man-aided experiments. The experience gained from this approach will be a key element in fully defining military man's role in space.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	70,356	71,500	72,983		Continuing	N/A

4. (U) OTHER APPROPRIATION FUNDS: Not applicable

5. RELATED ACTIVITIES: Expendable launch vehicles and their corresponding launch support are provided by Space Boosters, PE 35119F. Space Shuttle launch support is provided by Space Launch Support, PE 35171F. Host satellites for STP payloads include the Defense Meteorological Satellite Program (DMSP), PE 35160F; NASA Long Duration Exposure Facility, Navy Transit, NASA Tracking and Data Relay Satellite (TDRSS), National Oceanic and Atmospheric Administration (NOAA) TIROS-N, and classified programs. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Defense Nuclear Agency (DNA); Air Force Academy; Naval Post Graduate School; Naval Air Systems Command; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency, National Aeronautics and Space Administration; Defense Research Sciences, PE 61102F;

Geophysics, PE 62101F. Materials 62102F; Aerospace Propulsion, PE 62203F; Advanced Weapons, PE 62601F; Missile Surveillance Technology, PE 63424F; Surveillance Technology, PE 62428F; Space Communications, PE 63431; [ ] Based on previously independent mission developments the Combined Release and Radiation Effects Satellite (CRRES) mission has been established as a joint program between DOD (AF) and NASA. A Memorandum of Agreement has been signed between DOD (AF) and NASA that delineates roles and responsibilities for the program with DOD (AF) funding the CRRES spacecraft and NASA funding the Shuttle integration and orbital flight charges.

6. (U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles AFS, CA, is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the Space Test Program (STP). Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. Current payload integration and/or spacecraft contractors are Rockwell International, Seal Beach, CA (P888-Teal Ruby/P80-1 spacecraft); Lockheed Missiles and Space Company Sunnyvale, CA (P675-Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) IA/ Experiment Support System (ESS) spacecraft); through NASA, Ball Brothers, Boulder, CO (P86-1 Combined Release and Radiation Effects Satellite (CRRES); and through DNA, Johns Hopkins University/Applied Physics Laboratory (P87-1 Polar BEAR).

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2618, Quick Response Shuttle Missions. This STP project supports the flight of Quick Response Shuttle Payloads (QRSPs) on the Shuttle. This effort will establish and provide simplified integration procedures for QRSPs capable of responding to immediate DOD needs. These procedures will maximize near-term flight opportunities on both DOD and NASA Space Transportation System (STS) missions for QRSP experiments. QRSPs will include carry-on experiments, Get-Away-Specials and Hitchhiker-G opportunities. Man-in-space and standardized spaceflight hardware will be utilized to meet unique DOD payload requirements. This is not a new start. Prior to FY 1986, these types of experiments were carried out under Project 2620. Establishing the program under a separate project will enhance the fiscal and technical management of the program. Beginning in FY 1986, STP will attempt to manifest QRSP experiments on every available flight opportunity (15 Shuttle flights scheduled in FY 1986). To minimize integration efforts, STP will develop standard Get-Away Special services, including power, recording and overall integration support. To enhance mid-deck capabilities, STP will fabricate an advanced Shuttle Hatch Instrument Mount (SHIM) capable of providing accurate pointing for optical instruments (complete in 3Q FY 1986). A Mid-Deck Work Station will be constructed to automate monitoring of numerous carry-on experiments and enable better Shuttle interaction (complete in 3Q FY 1987). Hardware and procedures for future QRSP missions will be developed. This is a continuing program. The cost estimating techniques used for the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation models, and contractor estimates. Since no significant cost data base exists for the spaceflight of QRSP type experiments, STP program personnel are developing cost estimating capabilities as they gain experience in integration and operations activities associated with these types of payloads.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2617, Free-Flyer Spacecraft Missions

A. (U) Project Description: This Space Test Program project supports advances in DOD space technology by providing for the spaceflight of experiments on STP developed free-flyer spacecraft. These flights are used for the demonstration of new system technologies, concepts and designs and for determining space environmental effects on military space systems. In addition this project supports the spaceflight of small secondary payloads on free-flyer host spacecraft. The project provides for spacecraft procurement, payload integration, launch support, and orbital support. Space Shuttle launch support tasks are provided by PE 35171F, Space Launch Support. This project currently supports the on-orbit operations of the P83-1 HILAT Satellite, the development of STP spacecraft for the Polar Beacon Equipment and Auroral Research (Polar BEAR) mission and the joint DOD (AF)/NASA Combined Release and Radiation Effects Satellite (CRRES) mission. It also supports the integration of numerous secondary experiment missions on host spacecraft. To enhance fiscal and technical program management, the Teal Ruby/P80-1 spacecraft development effort previously supported by this project has been moved from this project to a dedicated project--Project 2619.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: The P83-1 HILAT Satellite (launched 27 June 1983) provided excellent data, including first daylight auroral imaging. The STP spaceflight plan for the STP/Defense Nuclear Agency (DNA) P87-1 Polar Beacon Experiment and Auroral Research (Polar BEAR) Mission was approved and a DOD (AF)/Defense Nuclear Agency Memorandum of Agreement was signed. The program initiated the development and acquisition of hardware to accomplish the Polar BEAR mission. The STP played a major role in the no-cost acquisition of a Transit Satellite structure from the Smithsonian National Air and Space Museum for use as a spacecraft bus to support the Polar BEAR experiments on orbit. The S85-1 Host Vehicle Pallet Mission was successfully launched on a This mission will gather space environment data for use in future spacecraft design. S80-1, a complement of five experiments, was successfully launched on 6 April 1984 from the Kennedy Space Center on the NASA Long Duration Exposure Facility (LDEF) recoverable free-flyer. The LDEF is scheduled for retrieval in February 1985. S80-1 experiments will determine space environmental effects on spacecraft materials and active/passive radiation hardened fiber optics components. Spacecraft Preliminary Design and Critical Design Reviews for Combined Release and Radiation Effects Satellite (CRRES) spacecraft were successfully completed. CRRES subsystem testing was initiated.

(2) (U) FY 1985 Program: CRRES subsystems will continue to be delivered and tested. Mission unique software development will be initiated. Spacecraft fabrication will begin. Support will be provided for integration of Auxiliary Master Tape at the Satellite Control Facility. CRRES spacecraft subsystem and experiment integration will begin. The program will support retrieval operations of LDEF/S80-1 experiments in late second quarter FY 1985 and complete the development and acquisition of hardware to accomplish the STP/DNA P87-1 Polar BEAR mission. Planning efforts for the procurement of a standard Shuttle recoverable STP free-flying spacecraft will begin. Efforts will continue to define future missions to support the spaceflight of other approved DOD experiments.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Integration and testing will be completed for the experiment complement for the Combined Release and Radiation Effects Satellite (CRRES) mission. Spacecraft system level and final acceptance testing will begin. Launch base operations will begin to support the fourth quarter FY 1987 launch. The CRRES spacecraft will perform a NASA chemical release mission in low earth orbit for three months and then will be boosted into a high altitude elliptical orbit to perform the DOD mission of evaluating the performance of state-of-the-art microelectronics in a high radiation space environment. Integration and testing will be completed for the experiment complement for the Polar Beacon Experiment and Auroral Research (Polar BEAR) mission. These experiments will collect data to improve our ability to predict auroral conditions and their effect on command, control, communications, intelligence and classified missions. Planning efforts to procure standard, Shuttle recoverable STP free-flying spacecraft will be finalized. Efforts to define future missions to support the spaceflight of other approved DOD experiments will continue. The cost estimating techniques used for the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation models, contractor estimates, and a large data base of experience from previous STP free-flyer spacecraft missions.

(4) (U) Program to Completion: This is a continuing program.

C. Major Milestones:

	Milestones		Dates
(1) (U)	Successful Scout launch of HILAT P83-1 spacecraft		27 June 1983
(2) (U)	Successful Shuttle launch of (Mission 41) NASA Long Duration Exposure Facility (LDEF) - host for S80-1		6 April 1984
(3)	Successful launch of S85-1 Host Vehicle Pallet (HVP)		
(4) (U)	Shuttle recovery of NASA LDEF - host for S80-1	*(3QFY 1985)	2QFY 1985
(5) (U)	Scout launch of Polar BEAR P87-1 spacecraft		1QFY 1987
(6) (U)	Shuttle launch of CRRES spacecraft	*(4QFY 1986)	4QFY 1987

* Date presented in FY 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(1) (U) Recovery moved up to accommodate Shuttle schedule
(2) (U) Slipped to accommodate switch to a larger kick stage rocket motor

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2619, Teal Ruby Mission

A. Project Description: This project supports the development of an STP spacecraft (P80-1) to support the Defense Advanced Research Projects Agency (DARPA)/AF Teal Ruby Mission (AF Program P888). The Teal Ruby mission, known by its primary DARPA payload of the same name, also carries Army, Navy, and National Aeronautics and Space Administration (NASA) secondary payloads. The DARPA experiment will demonstrate new infrared technologies and collect data needed for the design of future The spacecraft will also support three secondary payloads - a NASA designed ion thruster experiment testing capabilities for long-term satellite station-keeping, a Navy autonomous spacecraft navigation experiment and an Army ultraviolet spectrometer experiment studying the space ultraviolet (UV) spectrum. The Teal Ruby/P80-1 mission was contained in Project 2617 in the FY 1985 Descriptive Summary.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: Final testing of flight article subsystems began to support spacecraft (P80-1) development and the DARPA Teal Ruby sensor integration. Integrated systems testing began using the qualification Teal Ruby sensor. Command and control tests were completed at

(2) FY 1985 Program: Key efforts in this project in FY 1985 will be the completion of the Teal Ruby spacecraft, integration of the DARPA Teal Ruby flight sensor into the spacecraft, and final checkout of the total system. All of these efforts are geared to support the Teal Ruby launch date in

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Final systems checkout will be completed at The cost estimating techniques used for the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation models, contractor estimates and a large data base of experience from previous STP freeflyer spacecraft missions.

(4) Program to Completion: After launch in STP will support on-orbit operations of the P80-1 spacecraft and its experiments into the late 1980's.

C. (U) Major Milestones:

Milestones	Dates
Shuttle launch of Teal Ruby spacecraft on	

EXPLANATION OF MILESTONE CHANGES

was slipped in the interest of the overall

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2620, Shuttle Sortie Missions

A. (U) Project Description: This Space Test Program project advances DOD space technology by providing for the spaceflight of experiments on Shuttle sortie missions (payloads/experiments remain in Shuttle and are returned) for demonstrating new system technologies, concepts, and designs and for determining space environmental effects on military space systems. Through sortie missions using reusable, standard STP Shuttle experiment support equipment, STP accomplished its pathfinder role of exploiting the Shuttle as a manned DOD space laboratory. The project develops the capability to control payloads in the payload bay from the aft flight deck as well as the capability to actually store and perform payload experiments on the aft/mid flight deck. The project also supports the flight of secondary experiments in NASA Get-Away-Special (GAS) cans and on other support structures being flown in the Shuttle sortie mode. The experience gained on these sortie missions will be a key element in defining military man's role in space. Beginning in FY 1986, very simple experiments stored and performed on the aft/mid deck, or using GAS cans or other support structure will be supported by Project 2618 - Quick Response Shuttle Missions. The project provides for the procurement of reusable experiment support equipment; integration of payloads with the Shuttle experiment support equipment and the integration of the combination into the Shuttle; mission/payload specialist training on STP hardware; launch support, and on-orbit support. This project currently supports the Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) IA/Experiment Support System (ESS) mission (AF Program 675). Shuttle launch support is provided by PE 35171F, Space Launch Support.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: was completed and to support the P675 mission continued. P675 will be one of the Development of the interface hardware between the aft flight deck and the payload bay continued. Integration testing of the experiment interfaces commenced. Mission operations and astronaut/Manned Spaceflight Engineer (MSE) plans were developed to support mission requirements. STP successfully flew the Auroral Photography

Experiment (APE) as a carry-on experiment in the aft flight deck on Shuttle Mission 41A and Mission 41G. This experiment helped determine the auroral environmental effects on the Shuttle. A second carry-on experiment, CLOUDS, provided data on cloud morphology and the ability of man to identify surface features. This data will potentially be used for antisubmarine warfare surveillance. A third carry-on experiment, Radiation Monitor Experiment (RME), has flown on five missions beginning with Shuttle Mission 8 in August 1983. This experiment provides data for both DOD and NASA on radiation levels within the Shuttle cabin. It will be flown again on a number of missions in 1985 and 1986. A Get-Away-Special (GAS) Cosmic Ray Upset Experiment (CRUX) was flown on Shuttle Mission 41B. This experiment provided data on environmental effects, specifically soft error upsets on radiation hardened microelectronics. Another GAS experiment Trapped Ions in Space (TRIS), was flown on Shuttle Mission 41G. This experiment gathered data on ion levels for use in DOD communication propagation studies. The STP acquired and qualified camera equipment to support carry-on experiments. Efforts continued to define future sortie missions to support the spaceflight of other approved vehicles.

(2) FY 1985 Program: of the Experiment Support System (ESS) to support the P675 mission will be completed. Integration of all experiments will be completed and P675 testing will be completed to support the The primary P675 experiment, Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) IA, will gather data key to the development and operational use of the and future DOD infrared/optical space systems. The secondary experiments will gather data on the far and extreme ultraviolet (UV) to determine the utility of UV in to evaluate shuttle payload bay contamination; and evaluate the use of an X-ray camera in monitoring The P675 sortie plans to conduct the entire mission (control the experiments) from the aft flight deck of the Shuttle utilizing two trained military Manned Spaceflight Engineers (MSEs) and aft flight deck/payload bay interface equipment. Efforts will continue to define future sortie missions to support the spaceflight of other approved DOD experiments. Development/acquisition of equipment to support direct manned involvement with experimental payloads located in the Shuttle aft flight deck and in the payload bay will continue. Development of these capabilities will expedite the infusion of new technology into space systems through the use of more simple, less costly, incrementally designed, man-aided experiments. Experiment results and experience in using this approach will be key elements in fully defining military man's role in space. Some of this equipment will be used to support the establishment of the Quick Response Shuttle Payload (QRSP) program (Project 2618) beginning in FY 1986, which will allow rapid response to DOD requirements for the Shuttle flight of some types of DOD simple experiments.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: P675 is scheduled for launch on the After five to seven days on orbit, recovery will take place either at Edwards AFB or Kennedy Space Center. At the landing site, data tapes and films will be removed and distributed. The experiments will then be returned to the experimenters. The ESS will be tested, refurbished as required, and prepared for a future mission. Procurement efforts for the Sortie Pallet for Shuttle (SPAS) reusable spacecraft will be initiated. The SPAS can be removed from the Shuttle cargo bay by the remote manipulator system (RMS), fly in a free-flying mode near the Shuttle and be retrieved again by the RMS. Mission planning for the first Sortie Pallet

for Shuttle (SPAS) mission will be initiated and will include the integration of experiments to measure the environment in and around the Shuttle. Beginning in FY 1986, carry-on type payloads flown previously under this project will now be funded under Project 2618, Quick Response Shuttle Missions. Efforts will continue to define future sortie missions to support the spaceflight of other approved DOD experiments. The cost estimating techniques used for the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation models, and contractor estimates. Since no significant data base exists for Shuttle sortie type missions STP project personnel are developing cost estimating capabilities as they gain experience in integration and operation activities with the Shuttle.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Shuttle sortie mission of carry-on payload Radiation Monitor Experiment (RME)	30 August 1983 (Mission 8)
(2) (U) Shuttle sortie mission of carry-on payload Auroral Photography Experiment (APE)	30 November 1983 (Mission 41A)
(3) (U) Shuttle sortie mission Get-Away-Special (GAS) payload Cosmic Ray Upset Experiment (CRUX)	3 February 1984 (Mission 41B)
(4) (U) Shuttle sortie mission of carry-on payload RME	3 February 1984 (Mission 41B)
(5) (U) Shuttle sortie mission of carry-on payload RME	6 April 1984 (Mission 41C)
(6) (U) Shuttle sortie mission of carry-on payload CLOUDS	29 August 1984 (Mission 41D)
(7) (U) Shuttle sortie mission of carry-on payload RME	29 August 1984 (Mission 41D)
(8) (U) Shuttle sortie mission of carry-on payload RME	5 October 1984 (Mission 41G)
(9) (U) Shuttle sortie mission of carry-on payload APE	5 October 1984 (Mission 41G)
(10) (U) Shuttle sortie mission of GAS payload Trapped Ions in Space (TRIS)	5 October 1984 (Mission 41G)
(11) Shuttle sortie mission of P675 (Cryogenic Infrared Radiance Instrumentation for Shuttle IA/Experiment Support System)	

*Date presented in FY 1985 Descriptive Summary

EXPLANATION OF MILESTONE CHANGES

was slipped in the interest of the overall

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FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63438F
DOD Mission Area: #410 - Space Launch and Orbital Support

Title: Space Systems Survivability
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		29,511	5,519	4,273	5,488	Continuing	N/A
2611	Survivability Planning and Analysis	1,400	500	600	700	Continuing	N/A
2612	Satellite Survivability	11,311	3,319	3,173	4,288	Continuing	N/A
2613	Ground Station/Link Survivability	16,800	1,700	500	500	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program performs survivability planning and analysis and develops the necessary prototype hardware, software, technology, operational procedures, strategy, and tactics that will provide generic survivability capabilities for the military space systems of the United States. The program is structured to provide balanced survivability between all space systems elements: satellites, data/command links, and ground stations. Space systems are required to provide critical strategic and tactical support to national decision makers and military force commanders at all levels of conflict. They specifically provide missile attack warning, strategic and tactical navigation, surveillance, communications, and meteorological information. These systems provide support to strategic, tactical, and Rapid Deployment Forces on a global basis.

Failure to protect our space systems will result in the denial of their critical support to the National Command Authorities and our military forces during crisis and conflict. Major development efforts within this program include the following: 1) Satellite Defense System (SDS) - an defensive system for satellites which could counter the current and projected Soviet antisatellites; and 2) a Transportable Mobile Ground Station designed to improve the survivability of telemetry, tracking, and control and mission data handling capability. Survivability technologies developed under this program are made available to all satellite program offices for system level implementation.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	29,511	5,519	8,179		Continuing	N/A

RDT&E - The reduction in FY 1986 funding relative to the amount shown in the FY 1985 Descriptive Summary reflects a transfer of resources into Air Force programs of higher priority.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Strategic Defense Initiative (SDI) Support Programs (PE 63224C) contain a Survivability Project (#0010). This program element is managed by the DOD and the Air Force which is the lead Service for the survivability project. Efforts in the SDI Support Programs complement work in this program element. PE 62601F, Advanced Weapons, and PE 64711F, Systems Survivability, develop nuclear hardening technology which is applied in PE 63438F. PE 63431F, Advanced Space Communications Capabilities, develops communication systems technology which supports survivable tracking, telemetry, and control (TT&C) stations.

6. (U) WORK PERFORMED BY: The Air Force Systems Command's Space Division has overall responsibility for program management. Space Division executes the program, has responsbility for contractor oversight and performs technical analyses in support of all projects. GRC, Santa Barbara, CA is the contractor for survivability planning and analysis. The prime contractors for Satellite Defense Systems (SDS) concept development are: Boeing, Seattle, WA; Lockheed, Sunnyvale, CA; and TRW, Redondo Beach, CA. Ford Aerospace, Sunnyvale, CA, is the prime contractor for Transportable Mobile Ground Station (TMGS).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2611, Survivability Planning and Analysis. This project reviews the mission requirements for Department of Defense space systems, evaluates their vulnerability to current and future threats, and determines the most cost-effective methods to achieve required survivability. The results of these reviews and evaluations are published annually in a document called the Space Mission Survivability Implementation Plan (SMSIP). The update to the SMSIP was made in FY 1984. In FY 1984, a methodology to compare quantitatively the effectiveness of survivability enhancement options was developed. Development of policies and directives to implement a space system survivability strategy, consistent with the AF Space System Architecture, was initiated. In FY 1985, development of polices and directives to implement a space system survivability strategy, consistent with the AF Space System Architecture, will be completed. Development of long-term survivability criteria and investment strategies for DOD space systems, which are responsive to the growing threat, will continue in FY 1986. This is a continuing program.

B. (U) Project: 2612, Satellite Survivability. This project develops prototype survivability technologies, for deployment in the 1990s, to protect those U.S. satellites critical to our national defense. It develops prototype system level capabilities to counter the demonstrated conventional co-orbital, and the potential direct-ascent nuclear and laser antisatellite (ASAT) threats to DOD satellites. The project also demonstrates sensor survivability and laser hardening techniques necessary to protect critical U.S. space systems against various threats at all levels of conflict. Sensor survivability efforts include development and demonstration of devices which can counter laser jamming and/or devices which can withstand levels of laser radiation sufficient to cause physical damage. Other efforts will address survivability of sensors in enhanced electron radiation belts. Configuration Enhanced Radiation Rejection (CERR) materials to protect against the thermal effects of lasers on spacecraft structures are being developed. In FY 1984, work continued on the concept definition for the Satellite Defense System (SDS). Preliminary reviews and evaluations

of contractor concepts for the system were conducted. In FY 1985, concept definition work for the Satellite Defense System (SDS) will be completed and the concept evaluated. Programs to address key technologies identified during concept development will be initiated. Prototype laser anti-jam focal planes and sensors will be designed and fabrication begun. Hardened electron belt sensors will be designed. In FY 1986, laser anti-jam systems will be tested; electron belt sensors will be fabricated and tested; and an integrated test of sensors, detectors, and signal processing will be performed. Configuration Enhanced Radiation Rejection (CERR) hardware will be fabricated. This is a continuing program.

C. (U) Project: 2613, Ground Station/Link Survivability. This project develops concepts and demonstrates the technical feasibility of prototype hardware and new operational procedures to counter the threat against space system tracking, telemetry and control (TT&C) and mission data links, operations centers, and ground stations. It develops both prototype and initial operational capability systems. The project provides proven survivability improvements to support validated Statements of Need and Mission Element Need Statements (SONS/MENS) and attendant acquisition programs oriented toward space system ground stations and data links. In FY 1984, the Critical Design Review (CDR) for the Transportable Mobile Ground Station (TMGS) was held in March. In FY 1985, development of the TMGS will be completed and testing is scheduled for FY 1986. Responsibility for further development and testing of the TMGS will be transferred to the Satellite Control Facility (SCF). The SCF will use this validation model to develop operational requirements and production specifications for a Survivable Control System (SCS). In addition, TMGS will support contingency operations at the SCF and be studied for modification to support the Extremely High Frequency (EHF) Satellite Data Link Standard. Development of low power devices to detect jamming, provide warning, and initiate electronic countermeasures will begin. Hardware modifications to demonstrate use of anti-jam modems in domestic satellite (DOMSAT) terminals will be undertaken. Antiscintillation requirements for satellite earth terminals will be defined and prototype hardware design initiated. This is a continuing program.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64211F
DOD Mission Area: 452 - Aerial Targets

Title: Advanced Aerial Targets Development
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		10,078	3,409	13,505	12,719	Continuing	N/A
469A	Firebolt	5,000	0	0	0	0	54,358
2459	Target Payload Systems	5,078	3,409	7,005	3,219	Continuing	N/A
3165	QF-106 Full-Scale Aerial Target	0	0	6,500	9,500	5,800	21,800

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Aerial target development is key to ensuring the effectiveness and crew proficiency in the employment of our tactical forces against enemy threats. The overall objective is to improve air-to-air weapon system accuracy and reliability by developing aerial target systems for weapon system evaluation. The targets being developed will provide a proper mix of full-scale, subscale, and gunnery tow targets. Target Payload Systems will increase target effectiveness by improving subsystems for missile scoring and by developing subsystems which will provide target radar and infrared signatures representative of the threats. QF-106 development is required to provide a follow on to the QF-100 full-scale target. Full-scale targets are essential to provide a fully representative target with realistic maneuvering performance, radar cross section signature, and afterburning engine infrared signature.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	10,278	3,409	7,302		Continuing	N/A
Missile Procurement	0	3,991	7,947		Continuing	N/A

The FY 1986 difference in RDT&E funding is due to the initiation of the QF-106 Full-Scale Target project and a change in projected inflation.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Project 469A, Firebolt						
Missile Procurement						
Funds	0	3,990	7,928	9,839	Continuing	N/A
Quantity	0	2	6	8	Continuing	
N/A						

5. (U) RELATED ACTIVITIES: The Army and Navy are actively involved with the Air Force in the development of various target systems and subsystems. Cooperation and coordination are maintained under the auspices of the Joint Logistics Commanders through an active Joint Technical Coordinating Group for Aerial Targets. Additionally, formal coordination through the Department of Defense Armament/Munitions Requirements, Acquisition, and Development Committee ensures non-duplication of efforts. A related Air Force Program Element is PE 35116F, Aerial Targets, for procurement of targets.

6. (U) WORK PERFORMED BY: Much of the infrared augmentation effort in Project 2459, Target Payload Systems, is contracted to Hayes International, Birmingham, AL. The Laser Vector Scoring System in Target Payloads is designed by Santa Barbara Research Center, Goleta, CA. Target development effort is managed by Air Force Systems Command's Armament Division, Eglin Air Force Base, FL.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2459, Target Payload Systems This project provides development engineering for aerial target subsystems. These subsystems are required to provide scoring information and to augment the radar and infrared signatures of targets to provide more realistic representation of threats. In FY 1984, a new point source pod and a plume generator pod were both integrated and tested on the BQM-34A target. Subsystem tests for a pod to simulate an afterburner plume were conducted. Also in FY 1984, design effort began for integration of Laser Vector scoring into the Firebolt target, and integration of the Recovered Doppler Airborne Vector Scoring System into the QF-100 full-scale target was completed and tested. In FY 1985, infrared augmentation effort will shift to integration of the plume generator pod on the MQM-107B target while development of the afterburner simulator pod continues. Also infrared measurements of the signatures of target augmentation pods and the images of aircraft and targets will be collected. Firebolt Laser Vector Scoring effort will continue, and Recovered Doppler Airborne Vector Scoring on the QF-100 will support Advanced Medium Range Air-to-Air Missile development tests. FY 1986 integration of the plume generator is planned to be completed, and target integration of the afterburner simulator is scheduled to be initiated. Firebolt Laser Vector Scoring will begin ground and flight tests. Effort on radar augmentation will increase significantly. Radar augmentation development will concentrate on subsystems for subscale targets to provide a more complete representation of aircraft radar signature characteristics. Also, development effort increases in response to markedly increased emphasis on the need for electronic countermeasures on targets. Target subsystems will be developed for more comprehensive countermeasures on full-scale targets and for selected capabilities on subscale targets.

B. (U) Project: 3165, QF-106 Full-Scale Aerial Target. This is a new project. The QF-106 will be the full-scale target for the early 1990s. It replaces the QF-100, which is programmed for attrition by the third quarter of FY 1990. Full-scale development will be initiated in FY 1986 to convert retired F-106 aircraft into remotely controlled targets for production deliveries beginning in FY 1990. The QF-106 project will include design and integration of remotely controlled autopilot modifications, command and control telemetry systems, missile scoring systems, and infrared and electronic countermeasures. Source selection and contract award are scheduled for the end

of the first quarter followed by design development with System Design Review and Preliminary Design Review to occur before the end of FY 1986. QF-106 design will take advantage of F-106 similarity to the F-102, which served as the PQM-102 full-scale target, and will use the digital autopilot and other advances incorporated in the QF-100 design.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64227F
DOD Mission Area: 430 - Non-System Training Devices

Title: Flight Simulator Development
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		26,379	138,000	155,315	115,231	Continuing	N/A
2325	Simulator Development Activities	3,400	4,120	8,131	7,061	Continuing	N/A
2632	B-52 Offensive Avionics Station	0	1,700	7,561	0	0	9,261
2687	EF-111A Operational Flight Trainer	*	12,020	1,277	98	0	54,395
2769	Simulator Update Development	5,947	17,652	4,876	3,060	Continuing	N/A
2844	HH-60A Weapon System Trainer (WST)	0	150	12,471	27,987	38,054	78,662
2851	Standard Defense Mapping Agency (DMA) Data Base Transformation Program	637	1,430	1,473	2,947	2,593	9,080
2854/5	C-5/C-141 Aerial Refueling Part Task Trainer	*	4,427	1,905	196	0	14,028
2901	B-1B Weapon System Trainer	9,584	51,804	39,403	13,748	762	118,700
2902	T-46 Operational Flight Trainer	800	9,900	7,267	7,379	675	26,021
2903	F-15/F-16 Simulator for Air-to-Air Combat	2,700	2,400	2,455	1,964	0	9,519
2968	Simulator Modularity Design	600	1,333	3,235	3,010	3,924	12,102
2997	GBU-15 Part Task Trainer	294	4,900	9,569	3,567	48	18,378
2998	LANTIRN "CORE" Simulator	0	3,500	15,875	17,868	3,002	40,245
2999	F-15E LANTIRN Part Task Trainer	0	2,764	5,456	2,597	0	10,817
2985	Simulator Reliability & Maintainability	1,417	1,800	970	0	0	4,187
3000	KC-135 Operational Flight Trainer	0	6,000	17,956	15,281	1,766	41,003
3105	F-15E Weapon System Trainer	0	12,100	15,020	6,383	196	33,699
3135	Advanced Training System	0	0	415	1,790	7,002	9,207
3143	Advanced Tactical Fighter (ATF)	0	0	0	295	1[illegible],043	181,338

* Projects transferred to this PE in FY 1985.

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2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program for the engineering development of aircrew flight simulator techniques and training devices. The objectives of this program are to adapt flight simulation technology developed in the laboratories and industry to satisfy current training requirements and to develop prototype training devices. The FY 1985 Budget was the first in which flight simulator programs were consolidated into this program element to enhance control and visibility within the Air Force, Office of the Secretary of Defense (OSD) and Congress.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	24,279	149,880	145,909	N/A	Continuing	N/A

EXPLANATION: (U) In FY 1984, $600 thousand was reprogrammed for the T-46 Operational Flight Trainer (OFT) to allow delivery prior to the aircraft initial operational capability (IOC), $900 thousand was reprogrammed to support simulator modifications, and $600 thousand was added for cockpit procedures trainer. In FY 1985, Congress reduced the PE by $11.880 million. In FY 1986, funds were supported for the F-15E Weapon System Trainer (WST) ($15.3 million) development, to accelerate the HH-60A WST ($12.5 million) to provide a training capability concurrent with aircraft IOC, to initiate the Advanced Training System ($423 thousand), and to defer the B-52 WST update from FY 1985 to FY 1986 (+$7.6 million). To meet revised contracted and projected requirements, funds were reduced for the T-46 OFT (-$12.9 million), Simulator Update Development (-$10.5 million), and the GBU-15 Part Task Trainer (-$300 thousand). Other projects were reduced $2.3 million as a result of changes in the inflation rates.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Aircraft Procurement:

		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
2632	Funds (PE 11113F)	0	5,700	7,800	0	0	13,500
	Quantity	0	4	5	0	0	9
2687	Funds (PE 27252F)	1,000	23,400	0	0	0	24,400
	Quantity	0	1	0	0	0	1
2769	Funds (PE 27128F)	0	0	0	21,000	0	21,000
	Quantity	0	0	0	14	0	14
2769	Funds (PE 84742)	0	0	9,800	12,400	14,600	36,800
	Quantity	0	0	3	4	4	11
2854/5	Funds (PE 41119F/41118F)	0	32,700	0	0	0	32,700
	Quantity	0	6	0	0	0	6

Program Element: 64227F
DOD Mission Area: 430 - Non-System Training Devices

Title: Flight Simulator Development
Budget Activity: 6 - Defense-Wide Mission Support

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
2901	Funds (PE 11126F)	0	139,300	79,200	1,600	12,600	232,700
	Quantity	0	2	4	0	0	6
2902	Funds (PE 84741F)	0	0	0	27,400	56,600	84,000
	Quantity	0	0	0	3	7	10
2997	Funds (PE 27128F)	0	0	0	20,800	0	20,800
	Quantity	0	0	0	5	0	5
3000	Funds (PE 11142F)	0	0	0	34,700	68,300	103,000
	Quantity	0	0	0	7	11	18
3105	Funds (PE 27132F)	0	5,000	49,200	35,200	153,700	243,100
	Quantity	0	0	1	1	2	6
	Funds (PE 41115F)	0	13,200	13,600	0	0	26,800
	Quantity	0	2	2	0	0	4
	Military Construction:						
2687	Funds (PE 27252F)	0	1,700	0	0	0	1,700
2901	Funds (PE 11126F)	0	0	9,800	4,900	0	13,900
3000	Funds (PE 11142F)	0	0	800	7,000	2,500	10,300

5. (U) RELATED ACTIVITIES: Projects in this program rely on the technologies from inter- and intra-service coordination of technology base programs. This program relies heavily on the Air Force Human Resources Laboratory technology base programs. Specific programs which support this program include the following: PE 62205F, Training and Simulation Technology; PE 63277F, Advanced Simulator Development; and PE 63751F, Innovations in Education and Training.

6. (U) WORK PERFORMED BY: The Deputy for Simulators, Wright-Patterson Air Force Base, OH, is the in-house organization responsible for the majority of this element. The F-4E/G computer replacement, F-15/F-16 Simulator for Air-to-Air Combat (SAAC) and C-135 modifications are to be performed by Singer-Link Corp., Binghamton, NY. The EF-111A Operational Flight Trainer (OFT) and modification of the Simulator for Electronic Warfare Trainer (SEWT) were awarded to the AAI Corp., Baltimore, MD. Contractor for Phase II of the B-1B program is the Boeing Co., Wichita, KA. Reflectone Corp., Tampa, FL, was awarded the T-46 OFT and C-5/C-141 Air Refueling Part Task Trainer (ARPTT) contracts. Contractors have not been determined for the remaining weapon system specific projects. A total of twenty other contractors/organizations manage other efforts totalling $14 million. The Ogden Air Logistics Center, Hill AFB, UT, manages the modifications to the F-4E/G, C-135, and SEWT simulators.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2902, T-46A Operational Flight Trainer (OFT). Air Training Command requires deployment of OFTs, concurrent with the T-46 aircraft, that match the configuration and performance of the new training aircraft. The OFT must provide necessary cues and stimuli for training students in procedural (normal and emergency) activities, and instrument/navigational flight tasks. A total of 11 complexes will be procured, two for each operational site and one at the Pilot Instructor Training Facility. Each complex will consist of four student stations, four console operator stations, and four computational systems. The visual system and motion system of the existing T-37 Instrument Flight Simulator (IFS) will be used on the T-46A simulators. The facilities now housing the T-37 IFS will also be used for the T-46A OFT. In FY 1984 the Request For Proposal was released to industry and source selection completed. The contractors surveyed the existing T-37 IFS to determine what components will be useable in the T-46A simulation. The contract for development of the first complex was awarded to Reflectone, Inc., Tampa, FL on 2 October 1984. In FY 1985 the Preliminary Design Review (PDR) will be completed. Selected systems from a T-37 IFS will be provided to the contractor for future integration of the visual and motion subsystems. In FY 1986 the Critical Design Review (CDR) will be completed. Fabrication and hardware/software integration of the console operator station, computational system, and student station will be accomplished. In the outyears, in-plant government testing, teardown, packing, shipment to the field, and on-site acceptance testing will be completed. Supportability of the system will be verified, and production options exercised. Integration of remaining T-37 IFS components used in the new trainer will be accomplished on-site. Initial operating capability is planned for FY 1988, concurrent with the aircraft.

B. (U) Project: 2903, F-15/F-16 Simulator for Air-to-Air Combat. The Simulator for Air-to-Air Combat (SAAC) is an air combat trainer with two full field-of-view visual systems, used for Air Combat Engagement Simulation training, tactics development, training for instructor pilots/aggressors, and for research and development. The SAAC is presently configured with two F-4 cockpits. With replacement of the F-4 with the F-15 and F-16 aircraft, the SAAC cockpits need to be converted to an F-15 and F-16 configuration to permit training in these aircraft. The Request for Proposal was released, the contractor's proposal was evaluated, and the contract awarded in FY 1984. In FY 1985, "window three" of each existing visual display will be returned to the contractor for reshaping to allow both F-15 and F-16 cockpits unobstructed dome ingress and egress. The design review will be accomplished. The first F-15 cockpit will be designed, delivered, and integrated on-site. Required changes to the instructor station will be completed. In FY 1986, the first F-15 cockpit will be tested and accepted. The second F-15 cockpit will be delivered, integrated, and accepted. Design of the F-16 cockpit will be completed. Both F-16 cockpits will be delivered on-site and integrated with the SAAC. Final acceptance will occur during 1st quarter FY 1988, at which time training will begin.

C. (U) Project: 2851, Standard Defense Mapping Agency (DMA) Data Base Transformation Program. This is a joint development project initiated through the Joint Logistics Commanders to develop a standard DMA data base for simulator and common transformation programs, which are programs that convert standard digital DMA data into presentations for the aircrew (e.g., visual, radar, infrared). This software would be provided as government furnished equipment (GFE) to simulator manufacturers and would eliminate many of the problems and expense associated with the proliferation of

unique transformation programs and periodic updates due to specification and requirements changes. It will also assist in achieving transportability (e.g., transportable data bases between trainers). In FY 1984, the first task (of six in this program) was initiated. This effort, the data base requirements evaluation, consisted of an industry survey, description of all current and future simulator's use of digital data, a high level data base description, and common transformation program analysis. The contract for Task 2, Cost Benefit Analysis, was awarded the 4th quarter FY 1984. This study will accomplish a life cycle cost comparison between current acquisition strategies and the approach planned within this project. In FY 1985, the first and second tasks of this project, initiated in FY 1984, will be completed. Task 3, a transformation efficiency study, and Task 4, program requirements definition, which defines both data base content/format requirements, and the data base generation concept, will be completed. Task 5, program development, will begin in the 4th quarter FY 1985. Task 5, which will develop the format and structure for a standard simulator data base along with its update and maintenance structure, will be accomplished in FY 1986. This task will also develop a family of transformation programs to convert the data into simulator displays. In FY 1987, Task 6, evaluation and implementation, will be initiated and completed in FY 1989. This task involves completion of standard data base and common transformation programs and test and evaluation of these items in an existing simulator.

D. (U) Project: 2968, Simulator Modularity Design. A stong requirement exists to reduce simulator life cycle cost, reduce development lead time, improve our ability to deliver simulators to the field concurrently with the aircraft (and to keep the configuration current with the system fielded), and to increase the competitive base, through a modular systems design approach. This program consists of three phases. The first was a request for information (RFI) to the simulator industry to assess, from an industry perspective, the feasiblity of modular simulators, the advantages, disadvantages, cost, and potential impact on technology. The second phase was a competitive effort with Logicon, San Diego, CA, and the Boeing Co., Wichita, KA, to identify the tools necessary to implement modularity, and to develop a suggested specification, statement of work, and implementation strategy. Analysis of these phases will lead to phase III, development and validation, on an existing device, of the standards and tools necessary to achieve modularity. Both competing contractors completed their study efforts and submitted Phase II reports in July 1984. In FY 1985, the evaluation of Phase II will be accomplished. This will be a tri-service effort to analyze the contractors approaches, and select, combine, and/or modify the approach to Phase III given the technical, cost, and supportability considerations identified in the first two phases. The Request For Proposal will be developed and released for Phase III and the contract awarded the 4th quarter FY 1985. If funding permits, this will also be a competitive development. In FY 1986, the winning contractor's approach will be developed for implementation and validation on an existing training device. Initial evaluation activities will begin. In the outyears, implementation and evaluation of the selected approach will be completed.

E. (U) Project: 2325, Simulator Development Activities. This project funds engineering development of aircrew flight simulation techniques and training devices to satisfy current training requirements, to resolve identified deficiencies in training capabilities, to improve concurrency between aircraft and flight simulators, and to reduce life cycle costs. A total of approximately 27 tasks are being accomplished within this project. They include such efforts as radar sensor data base development; completion of the Digital Imaging Facility (DIF) and evaluation of the

application to synthetic aperture radar simulation; completion of engineering development and evaluation of a helmet mounted visual display; completion of the eye slaved integration and test using a helmet mounted occulometer; development of a standard multi-station instructor/operator station; review of distributed architecture and microprocessors; assessment of aircraft/simulator handling comparison; development of authoring system for computer based instructional system; and development of a generic training requirements definition trainer. In FY 1984, the Air Force continued developing the Digital Imaging Facility (DIF), completed the prototype occulometer and limited visual display, continued development of the computer image generated data base management system, and the Defense Mapping Agency Level V evaluation, began the instructional features analysis, and completed the G-Seat/G-Suit cueing study. In FY 1985, test of the helmet mounted visual displays will begin, the handbook on instructional features, and the DIF will be completed, test of miniraster insert will be contracted, and we will continue evaluation of simulation of synthetic aperture radar (SAR) applications, and development of digital radar landmass simulation test methodology. In FY 1986, we will complete the eye slaved display integration and test and pilot test of helmet mounted visual systems. The handbook on instructional features for designers use will be automated. The analysis of aircraft versus simulator handling qualities and the evaluation of an approach to front end analysis will be completed, and high resolution radar simulation development with SAR effects, studies, and advanced radar simulation test methodology will continue. We will improve maintenance training equipment instructional features, and initiate competitive development of a low cost visual system and prototype fighter attack visual display.

F. (U) Project: 2997, GBU-15 Part Task Trainer. The Tactical Air Forces (TAF) require a low cost, ground-based device for training F-4E, F-15E, and F-111F Weapon System Operators (WSOs) in the employment of the GBU-15 Precision Guided Munition (PGM). Many of the primary skills required by aircrews cannot be routinely practiced in the aircraft due to operational constraints, signal radiation restrictions, and the high cost of employing live PGMs. The current TAC simulators cannot train operators on the electro-optical/infrared mission specifics, and the costs to integrate this capability into the existing devices is prohibitive. The GBU-15 Part Task Trainer (PTT) will allow practice in controlling the weapon from launch to target impact, providing the WSO the opportunity for hands-on systems operation during initial qualification training. It will also help maintain skill levels of qualified aircrews while saving valuable sorties and munitions resources. A total of six (one development and five production) GBU-15 PTTs will be procured. Each will consist of a student station for the WSO, a limited instructor station, computational system, and an image generation system to provide the simulated video, environmental effects, and required gaming area. This effort begins in FY 1985. The Request For Proposal will be released, source selection activities will be conducted, and the development contract awarded. Also, the generic IR trainer to teach target recognition, and the intermediate GBU-15 PTT, which will provide an interim training capability, will be accomplished. In FY 1986, the Preliminary and Critical Design Reviews will be conducted, followed by initiation of fabrication of the student, instructor, computational, and image generation subsystems. In-process technical publication reviews will be conducted. Fabrication of the subsystems, and both hardware and software integration will be completed in FY 1987. Contractor in-plant, Air Force Qualification, and on-site acceptance testing will be conducted. The Physical and Functional Configuration Audits will be completed and technical publications validated. The option for the five production units will also be exercised in FY 1987. The development unit will be ready for training in FY 1987, and the production units will be accepted in FY 1988.

G. (U) Project: 2985, Simulator Reliability and Maintainability (R&M). The need to improve the R&M of both existing and planned flight simulators has been identified through the Simulator Advisory Group, the Air Force Huma Resources Laboratory (AFHRL) and various technical needs submitted by the major commands. Primary requirements revolve around the following: low reliability of simulator instruments; degraded reliability of modified aircraft computers used in a continuous operating environment; and the need to develop a data base to track, resolve and to influence design decisions. This project includes four primary tasks to improve simulator reliability and maintainability (R&M) in the most critical areas identified to date. Much of this effort is based on preliminary studies and reviews conducted by Air Force Systems Command over the past several years. In FY 1984, methods available to improve simulator R&M were reviewed and potential tasks have been identified and prioritized. Three of the four tasks were initiated: the field performance tracking system, simulation versus stimulation of simulator flight instruments, and the simulator support alternatives analysis study. In FY 1985, the simulation versus stimulation of simulator flight instruments studies, and the simulator support alternatives analysis will be completed. The Very High Speed Integrated Circuit (VHSIC) technology applicability for simulator image generator study will be initiated. Work on the field performance tracking system will continue. In FY 1986, development of the Field Performance Tracking System will be completed, the Physical Configuration Audit will be completed and implementation will begin. The Field Performance Tracking System will be integrated with the Air Force Logistics Command (AFLC) Product Performance Feedback System, data collected and follow-on activities initiated.

H. (U) Project: 2854/5, C-5/C-141, Aerial Refueling Part Task Trainer (ARPTT). Use of aircraft for Military Airlift Command (MAC) C-5 pilot air refueling (AR) training is expensive and requires dedicated support by the Strategic Air Command tanker force. Tanker support for training is limited, and MAC does not have aircrew training devices for AR qualification and continuation training. Even if C-5 flight simulators were adequately equipped, there is insufficient machine time available to satisfy AR training requirements. The ARPTT is a synthetic training device that provides the fundamental visual, audio, flight control, and buffet cues necessary for realistic AR training. It uses a common cockpit design for both the C-5 and C-141 and allows precontact and contact training with both KC-135 and KC-10 tankers. In FY 1984, the design was completed through the Preliminary and Critical Design Reviews. The production option will be exercised early in FY 1985. Fabrication and hardware and software integration will be completed and the contractor will conduct in-plant test prior to initiation of Air Force qualification testing in early FY 1986. Also in FY 1986, in-plant qualification testing, delivery on-site, and Air Force acceptance testing will be completed. All trainers will be delivered and accepted on-site.

I. (U) Project: 2687, EF-111A Operational Flight Trainer (OFT). Tactical Air Forces (TAF) require development of an Operational Flight Trainer (OFT) to facilitate training of both pilots and electronic warfare officers in new missions and on unique equipment. Requirement for this equipment is dictated by the absence of available training ranges in the free world, transfer of duties required in varying mission profiles and restrictions on peacetime flight which preclude realistic operation of electronic warfare equipment. The OFT consists of a two-place simulator which provides a training environment for the EF-111 mission, including the capability of simulating central European radar environment and all aircraft flight profiles. Critical Design Review was accomplished and hardware/software

integration initiated in FY 1984. In FY 1985, hardware and software integration will be completed, and a Test Readiness Review conducted. In-plant testing of the program subsystems will be conducted and completed. Reliability and maintainability demonstrations will be performed, and the initial Physical Configuration Audit (PCA) and Functional Configuration Audit (FCA) will be accomplished. The production option for the second simulator will be exercised for delivery to Upper Heyford AB, UK. Upon successful completion of in-plant test, the prototype Operational Flight Trainer (OFT) will be disassembled and shipped to Mountain Home AFB, ID, for assembly. In FY 1986, the prototype OFT will be assembled on-site and acceptance testing conducted. The final PCA and FCA will be accomplished and the device accepted as being ready for training. The contractor, AAI Corp., Baltimore, MD, will conduct all maintenance for the first three years through the contractor logistics support (CLS) contract. Production of the second OFT will be completed.

J. (U) Project: 3135, Advanced Training System (ATS). Changes to the Air Force training environment have resulted in increased training workload at Air Training Command (ATC) Technical Training Centers. Greater equipment complexities have resulted in greater student instructional needs. As training requirements have increased the number of experienced instructors has decreased. ATC is currently conducting little remedial or individualized instruction. This results in a greater number of personnel in the training pipeline, increased attrition, lower achievement, and ultimately reduced operational readiness. Military Airlift Command (MAC), Air Force Systems Command (AFSC), and Strategic Air Command (SAC) also have similar requirements to be supported by this project. The Advanced Training System (ATS) is a three phased program to provide a computer based training system to alleviate this deficiency. Phase I is a contracted concept explanation and validation effort that was completed in September 1984 and was funded and managed by ATC. Phase II develops the prototype system for two courses at one ATC Technical Training Center. Phase III acquires systems for the other four centers. ATS will provide information presentation, demonstration, drill and practice, evaluation, feedback, and remedial training. Its main goals are to free instructors for remedial instruction, training complex tasks, promote efficient training methods, and provide rapid course updating. The ATS program responds to the Defense Science Board 1982 Summer Study on Technical Training which recommended improvements to our training approach. In FY 1984, the concept explanation and validation effort was completed. In FY 1985, the system specification will be prepared for Phase II, and the development site and courses will be selected. In FY 1986, the development contract will be awarded. Development will progress through the Preliminary Design review and the initial hardware selection made. In the outyears, we will complete development, and collect training effectiveness information on the approaches selected.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2901 - B-1B Weapon System Trainer (WST)

A. (U) Project Description: The Strategic Air Command requires development of a training system to meet the training needs of all B-1B crew members. Required training tasks include mission rehearsal training for takeoff and landing, navigation, air refueling, threat analysis/countermeasures, low level penetration, weapons delivery, and

emergency procedures. Emphasis will be placed on training tasks that cannot be accomplished in the aircraft and on integrated crew training. These tasks include those related to safety of flight, emergency procedures, emergency war order rehearsal and others for which a suitable training environment does not exist. The acquisition strategy involves two phases: in Phase I the Air Force will select two contractors to complete the design through the Preliminary Design Review (PDR), at which point a single contractor will be selected to complete the procurement in Phase II. A total of five Weapon System Trainers (WSTs), which simulate all four crew positions, and one or two Mission Trainers (MT), which simulate only the offensive and defensive positions, and up to six cockpit procedures trainers (CPT) will be procured. In the WST, crews can be trained in either an integrated or independent mode. Trainers will be capable of providing war order mission rehearsal.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Phase I, the competitive development of the WST through the Preliminary Design Review (FDR), was completed. Source selection was conducted to select the winning contractor to complete the WST development and production for Phase II. The logistics support concept (i.e., contractor maintenance) was directed by the Air Staff.

(2) (U) FY 1985 Program: The Phase II contract has been awarded. The effort includes completion of design, development, test, evaluation and deployment of the WST. The contractor will complete design of the WST and Mission Trainer through Critical Design Review (CDR). Production options will be exercised for two WSTs, the Software Support Center, and six cockpit procedures trainers.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Development of the prototype WST, fabrication and hardware and software integration, will be completed and the contractor will begin in-plant test. Production options for two WSTs and Mission Trainer(s) will be exercised. The CDR on these units, consisting of updates required as a result of aircraft changes, will be conducted. The estimating technique included both parametric and bottom up, and was updated after receipt of contractor's proposals.

(4) (U) Program to Completion: In-plant government test, delivery of the prototype WST, installation, and on-site acceptance will be completed. Production units will be delivered, and contractor logistics support will be implemented. An aggressive update program will be continued to ensure configuration of the training system is maintained current with that of the aircraft.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Release Request-for-Proposal	March 1983
(2) (U) Contract Award for Phase I (two contractors)	August 1983

(3)	(U)	Preliminary Design Review	June 1984
(4)	(U)	Contract Awarded for Phase II	October 1984
(5)	(U)	Critical Design Reveiw	4th Quarter FY 1985
(6)	(U)	Delivery of first two Cockpit Procedures Trainers	3rd Quarter FY 1986
(7)	(U)	Prototype Weapon System Trainer Ready-for-Training (RFT)	1st Quarter FY 1988
(8)	(U)	Mission Trainer Ready-for-Training	4th Quarter FY 1988
(9)	(U)	WST Production Unit No. 5 RFT	4th Qarrter FY 1989

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2998/2999 - LANTIRN "Core" Simulator and Part Task Trainer (PTT)

A. (U) Project Description: Tactical Air Command (TAC) requires a safe, efficient means of training aircrews in accomplishing the LANTIRN mission in a high threat, real-time, heavily loaded task environment to be encountered in employing this system. LANTIRN provides a day/night/under-the-weather capability to fly and navigate at low altitudes and to acquire, track, and destroy ground targets. Successful interdication and close air support missions against the projected threat require accurate target acquisition and weapons delivery. To be able to perform this mission during night and adverse weather conditions, the pilot must be fully trained. The complexity and inherent danger of operating the LANTIRN system requires part task trainers for initial switchology training and F-16 and A-10 Operational Flight Trainers (OFTs) with LANTIRN simulation capability for full mission training. Training will include normal and emergency procedures, low level, navigation, target recognition and weapons delivery training. This project develops a "core" LANTIRN simulator to be integrated with, as a minimum, the F-16 and A-10 OFTs to provide full mission training. This device will include a computer image generation (CIG) system for the navigation pod and a higher resolution simulation capability for target recognition and weapons delivery tasks. Also to be developed for switchology, modology, and symbology training at the combat crew training squadron will be an F-15E, F-16, and A-10 configured Part Task Trainer.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: An interim device is being developed for training A-10 and F-16 aircrews until the LANTIRN core device is fielded. Results of effectiveness studies conducted on this device will be input to the core system. Further, an industry survey is being conducted of emerging technologies to assess the best method of training aircrews in employment of infrared based weapon systems.

(2) (U) FY 1985 Program: The request for proposal will be released, source selection activities will be completed and the contract awarded for both the core devices and the F-15E Part Task Trainer. The interim device will be completed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The design of the image generator system, computational system, and changes required to the flight simulator student stations will be completed and the Preliminary and Critical Design Reviews will be conducted. The gaming area will be completed for mountainous, hilly, coastal, and desert terrain, for all seasons, at varying times during the day and night.

(4) (U) Program to Completion: Fabrication of the computer image generation (CIG) and forward looking infrared radar image generation and display subsystems, computational subsystem, transformation programs, instructor station changes, and data base development will be initiated. Following hardware and software integration, contractor in-plant tests and Government qualification tests will be conducted. Production options for core devices for the A-10 and F-16 simulators will be exercised. The PTT will be delivered. Within the F-16 program line, the prototype LANTIRN core simulator will be integrated with an F-16 OFT, tested, and accepted by the Government. Contractor support of delivered systems will commence. Support packages allowing for recompetition of contractor logistics support will be available.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Tactical Air Force (TAF) State of Need (SON) 302-81	11 March 1981
(2) (U) Validate Requirement	11 December 1981
(3) (U) Release Request for Proposal	October 1984
(4) (U) Contract Award	March 1985
(5) (U) Preliminary Design Review	3rd Quarter FY 1985
(6) (U) Critical Design Review	1st Quarter FY 1986
(7) (U) Hardware/Software Integration	1st Quarter FY 1986 - 1st Quarter FY 1987
(8) (U) In-Plant Testing	1st Quarter FY 1987 - 1st Quarter FY 1988
(9) (U) Exercise Production Option	1st Quarter FY 1988
(10) (U) Integration with F-16 Simulator	2nd Quarter FY 1988
(11) (U) Acceptance Testing	1st Quarter FY 1988 - 4th Quarter FY 1988
(12) (U) Part Task Trainer Ready for Training	4th Quarter FY 1987
(13) (U) Prototype Core Simulator Ready for Training	4th Quarter FY 1988

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3000 - KC-135 Operational Flight Trainer

A. (U) Project Description: To train its KC-135 crews, Strategic Air Command (SAC) requires updated Operational Flight Trainers (OFTs) to replace the outdated and logistically unsupportable MB-26 trainers. The MB-26 is based on 25 year old analog technology, is logistically unsupportable, and does not fully represent the current

aircraft configuration because of the inability to add new capabilities to this old device. These devices are expensive to maintain, achieve very low availability rates, and provide marginal training in procedures only. In July 1981, the Aircraft Safety and Operations Review Board, after investigating several KC-135 accidents, highlighted the need for new simulators, particularly for engine out and emergency procedures training. Introduction of the KC-135R reengining program reemphasizes the need for this program. A total of 19 updated KC-135 OFTs is required. The KC-135 OFT will realistically simulate the pilot and copilot stations, and incorporate an on-board instructor's station. A computer image generated four window visual system for takeoff/landing and engine out training will be provided with a night/dusk capability. An accurate simulation of the total aircraft flight envelope will be included, and instrument flight simulation will be certifiable to meet SAC requirements for annual instrument evaluations. A total of 19 trainers will be upgraded to the KC-135 OFT configuration (approximately 11 in the KC-135A configuration, and eight in the KC-135R configuration).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: A draft request for proposal was prepared and released to prospective contractors. Contractors surveyed an existing MB-26 trainer to determine what elements of the device may be useful in their proposed approach to this program.

(2) (U) FY 1985 Program: Based on release of the final request for proposal (RFP) and the contractors' evaluation of the existing devices, proposals will be submitted. The Government will complete source selection and award the contract for the initial unit.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The contractor will progress with design and development of the flight station, aerodynamics, student stations, instructor station, computational system, and integration of the visual system, leading to Preliminary Design Review. Both the Preliminary and Critical Design Reviews (CDR) will be conducted and fabrication, hardware and software integration will begin.

(4) (U) Program to Completion: The production option for the first lot will be exercised following CDR. Contractor in-plant testing and Government qualification testing will be conducted, followed by shipment to the field for final acceptance testing and completion of the Physical and Functional Configuration Audits. Production options for the remaining devices will be exercised. The existing MB-26s will be provided to the contractor incrementally for refurbishment or to extract hardware for use on the new devices. The refurbished trainers will be contractor supported.

C. (U) Major Milestones:

Program Element: 64227F
DOD Mission Area: 430 - Non-System Training Devices

Title: Flight Simulator Development
Budget Activity: 6 - Defense-Wide Mission Support

	Milestones	Dates
(1) (U)	Strategic Air Command (SAC) Required Operational Capability (ROC) 10-74	June 1974
(2) (U)	Revision 1 to ROC	February 1980
(3) (U)	Validate Requirement	November 1980
(4) (U)	Release Request for Proposal	February 1985
(5) (U)	Contract Award	September 1985
(6) (U)	Preliminary Design Review	March 1986
(7) (U)	Critical Design Review	4th Quarter FY 1986
(8) (U)	Hardware/Software Integration	4th Quarter FY 1986 - 4th Quarter FY 1987
(9) (U)	In-Plant On-Site Testing	4th Quarter FY 1986 - 3rd Quarter FY 1988
(10) (U)	Exercise First Production Option	2nd Quarter FY 1987
(11) (U)	First Trainer Ready for Training	4th Quarter FY 1988
(12) (U)	Exercise Fourth Production Option	2nd Quarter FY 1990

11. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2844 - HH-60A Weapon System Trainer:

A. (U) Project Description: Military Airlift Command (MAC) requires additional and more capable combat rescue helicopters. Integral to this requirement is the need for an initial and continuation training capability, essential to developing and maintaining aircrew readiness. The defined HH-60A Aircrew Training Devices (ATD) program provides a family of devices addressing the range of training from the single critical task of operation/management of the Multi-Function Displays (MFD's) to the complete tactical mission. A single acquisition will be structured to acquire one Weapon System Trainer (WST), one Cockpit Procedures Trainer (CPT), and ten Part Task Trainers (PTT). The WST will consist of a student station, an on-board instructor station, a computational system, a motion simulation, and an image generation system providing the cues and stimuli for training the complete tactical mission. The CPT will consist of a student station, an on-board instructor station, and a computational system providing the cues and stimuli in training normal and emergency operating procedures, safety-of-flight, and system malfunction procedures. The PTT will also include a cockpit mockup and a microcomputer system providing self-paced training in the operation/management of the MFD's. Contractor Support (CS) will be implemented on all devices under a separate contract.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Based on a task analysis, the training requirements and mix of devices were defined. Request for Proposal (RFP) preparation began.

(2) (U) FY 1985 Program: The RFP will be released and source selection conducted.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The acquisition contract will be awarded. Contractor Support (CS) contract will be awarded and transferred to Air Force Logistics Command (AFLC) for management. Preliminary Design Reviews (PDR's) and Critical Design Reviews (CDR's) will be conducted on the Part Task Trainers (PTT) and Cockpit Procedures Trainer (CPT). PDR will be conducted on the Weapon System Trainer (WST).

(4) (U) Program to Completion: All elements of the training system will be fabricated, assembled, tested, and provided for training. Phasing of the deliveries will correspond to the aircraft deliveries with the CPTs and PTTs providing an initial safety of flight training capability.

C. (U) Major Milestones:

	Milestones	Dates
(1) (U)	Military Airlift Command (MAC) General Operating Requirement 4-77	December 1977
(2) (U)	Validate Requirement	September 1979
(3) (U)	Release Request for Proposal	April 1985
(4) (U)	Weapon System Trainer (WST) Contract Award	November 1985
(5) (U)	Critical Design Review (CDR)	May 1986 - November 1986
(6) (U)	First Production Option (6 Part Task Trainers (PTT))	1st Quarter FY 1987
(7) (U)	Second Production Option (3 PTT)	1st Quarter FY 1988
(8) (U)	PTTS Ready for Training (RFT)	September 1987 - February 1989
(9) (U)	CPT RFT	June 1988
(10) (U)	Weapon System Trainer RFT	November 1989

12. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 3105, F-15E - Weapon System Trainer (WST)

A. (U) Project Description: The Tactical Air Forces (TAF) requirement for a fighter that can conduct interdiction bombing as well as air-to-air missions must be supported by an aircrew training system that is capable of training all mission aspects. The F-15E WST will train both pilot and weapon system officers, and will include LANTIRN simulation. The trainers will be a modification of the F-15 OFTs being manufactured by Goodyear Aerospace Corporation, Akron, Ohio. Six WSTs will be procured.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Request for proposal released and contractor proposal submitted.

(2) (U) FY 1985 Program: The development contract for the WST will be awarded.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The preliminary design will be completed and the Preliminary Design Review (PDR) conducted. Detailed design of the flight station, instructor station, computational system, and LANTIRN Simulation will continue. Fabrication of cabling assemblies will begin.

(4) (U) Program to Completion: The Critical Design Review will be conducted, hardware/software integration and testing completed, the Functional and Physical Configuration Audits conducted, and the prototype will be accepted. Options for the remaining devices will be exercised.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Advanced Change Notice	September 1983
(2) (U) Contract Award	December 1984
(3) (U) Preliminary Design Review	December 1985
(4) (U) Critical Design Review	December 1986
(5) (U) Exercise Production Option	December 1986
(6) (U) In-Plant Test	4th Quarter FY 1987 - 2nd Quarter FY 1988
(7) (U) First Weapon System Trainer (WST) Ready for Training	4th Quarter FY 1988
(8) (U) Sixth WST Ready for Training	4th Quarter FY 1993

13. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2769/2632 - Simulator Update Development and B-52 Offensive Avionics Station (OAS)

A. (U) Project Description: As flight simulator systems age and technology changes, these systems become increasingly costly and difficult to support, typically due to non-availability of spare parts. This project primarily funds updates to these systems to maintain and improve their supportability and effectiveness. This project also funds changes to lower order Part Task Trainers. Includes refurbishment and upgrade, with addition of the ALQ-99 to the T-5 Simulator for Electronic Warfare, digitization and upgrade of the C-135 Operational Flight Simulators, digitization of the F-4 simulators, and modifications to the B-52 Electro Optical Viewing System and the B-52 Offensive Avionics Station, and replaces the logistically unsupportable terrain model visual system on the Undergraduate Pilot Trainer Instrument Flight Simulator (UPT-IFS) with a computer generated image visual system.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Initiated modification and update to the T-5 Simulator for Electronic Warfare Trainers and the C-135 Operational Flight Trainer. Completed development through Critical Design review.

(2) (U) FY 1985 Program: Initiate replacement of the obsolete and unsupportable GP-4B computers on the F-4 Operational Flight Simulators. Procure from the prime contractor, Singer-Link Corp, Binghampton, NY, sufficient data to initiate this update and prepare the request for proposal for a competitive solicitation to industry. Complete fabrication of the T-5 simulator. Initiate replacement of the terrain model boards on UPT-IFS visual system with computer image generated system. Initiate update of the B-52 Weapon System Trainer (WST) with Offensive Avionics Station (OAS) and strategic radar modifications.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Conduct Critical Design Review on the computer replacement for the F-4 simulator, complete prototype fabrication, and begin in-plant testing. Complete the Fuel Savings Advisory System (FSAS) modification on the C-135 trainers. Complete testing of the T-5 simulator upgrade. Complete testing of the visual system replacement for the Undergraduate Pilot Training Instrument Flight Simulator (UPT-IFS). Complete upgrade of the B-52 WST OAS to the Block II and strategic radar configuration.

(4) (U) Program to Completion: Upgrade the computational System on the Simulator for Air-to-Air Combat. Continue upgrade to existing devices.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Contract Award T-5 and C-135	2nd Quarter FY 1983
(2) (U) Contract Award F-4 Upgrade	2nd Quarter FY 1985
(3) (U) Contract Award B-52 WST OAS	3rd Quarter FY 1985
(4) (U) Contract Award UPT-IFS Visual	3rd Quarter FY 1985
(5) (U) Ready-for-Training (C-135/T-5)	1st Quarter FY 1985
(6) (U) Ready-for-Training (C-135 Fuel Savings Advisory System)	3rd Quarter FY 1986

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64237F
DOD Mission Area: #221 - Counter Air

Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA)
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	391	8,812	24,656	33,859

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program is a FY 1986 new start which develops a supersonic high performance fighter in-flight simulator as a replacement for the subsonic NT-33A. For the past 25 years, the R&D flight test community (AF, Navy, NASA, industry) has extensively employed the variable stability NT-33 for pre-first flight analysis of modern fighters, to establish flying quality specification criteria, and as a flying laboratory for control/display elements. The NT-33A has been a veritable workhorse with a full schedule of test activities. However, the NT-33A performance (40 year old aircraft design) is no longer representative of future fighter performance and must be replaced. The Advanced Tactical Fighter (ATF) and its related control/avionics is projected to be the next major AF fighter development which would benefit from the VISTA capability. VISTA will identify crucial flight control and human factor design deficiencies for correction before final design review of weapon systems. Saving just one prototype aircraft would justify the VISTA program. The NT-33A has been credited with identification of flight control deficiencies on both the YF-17 and F-18 aircraft, which likely would have resulted in loss of the aircraft had they not been corrected prior to first flight. With VISTA, the Air Force and Navy Test Pilot Schools will train test pilots to identify flying quality deficiencies and avionic system human factor characteristics in a realistic high performance environment. VISTA will serve as a national facility for Air Force, Navy, NASA, industry, and international flying research.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not applicable.

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This program will support, primarily, Air Force flying qualities research.

6. (U) WORK PERFORMED BY: Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH and a selected contractor under a competitive procurement.

Program Element: #64237F
DOD Mission Area: #221 - Counter Air

Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA)
Budget Activity: #6 - Defense-Wide Mission Support

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 64237F, Variable Stability In-Flight Simulator Test Aircraft (VISTA)

A. (U) Project Description: An existing fighter will be modified with variable stability controls and a reprogrammable cockpit to perform flight research in flying qualities, flight control and avionics technology, and man-machine experimentation. A conceptual design study was initiated in FY 1982 under Aerospace Flight Dynamics, PE 62201F and will be completed in FY 1985. Technical design and cost (acquisition and life cycle) tradeoff are being performed for candidate aircraft. A steering group of Air Force, Navy, and NASA users has been formed to review the requirements and to recommend the aircraft to be modified. Based upon a long history of in-flight simulators, the VISTA project is technically a low risk program. Components (computers, sensors, servos) for the variable stability controls and programmable displays are readily available off-the-shelf or can easily be modified to satisfy requirements Digital fly-bywire technologies have been validated in Advanced Fighter Technology Integrator (AFTI) F-16, PE 63245F.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not applicable.

(2) (U) FY 1985 Program: Not applicable.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: A request for Proposal will be initiated Source Selection completed, and a contract awarded for development of VISTA. Preliminary design will begin with the variable stability controls design, cockpit modification design, and initiation of aircraft configuration design modifications for the selected aircraft. The preliminary design will be completed in mid-FY 1987. Program cost estimates are based upon a very recent preliminary concept design study including cost trade-off estimates from potential prime contractors. VISTA will be a modification of an existing production fighter aircraft to serve as a national facility for simulating advanced fighter aircraft. This will be a competitive procurement.

(4) (U) Program to Completion: VISTA is scheduled for completion in the fourth quarter FY 1989. Following the Preliminary Design Phase in mid-FY 1987, the Detailed Design Phase will be undertaken with hardware development, simulation verification, aircraft modification, and ground test flight certification in FY 1987. Flight test verification will be accomplished in FY 1989 and transition to flight research programs during FY 1990.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Request for Proposal	1 Qtr, FY 1986
(2) (U) Source Selection Completed	2 Qtr, FY 1986
(3) (U) Award Contract	3 Qtr, FY 1986
(4) (U) System Design Completed	3 Qtr, FY 1987
(5) (U) Aircraft Modification Completed	3 Qtr, FY 1988
(6) (U) Ground Check-out Completed	4 Qtr, FY 1988
(7) (U) First Flight	1 Qtr, FY 1989
(8) (U) Flight Test and Certification Completed	4 Qtr, FY 1989
(9) (U) Transition to Flight Research Program	1 Qtr, FY 1990

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64411F   Title: Space Shuttle
DOD Mission Area: #410 - Space Launch Orbital Support   Budget Activity: #6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimate Cost
TOTAL FOR PROGRAM ELEMENT		332,104	337,000	132,007	39,150	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To increase the effectiveness of Department of Defense (DOD) space operations, this program will: (1) Support the National Aeronautics and Space Administration (NASA) development and assure the utility to the DOD of the Space Transportation System (STS); (2) Support transition of critical national defense satellites to the Shuttle; (3) Develop the Inertial Upper Stage (IUS); (4) Acquire general purpose Shuttle launch and landing facilities at Vandenberg Air Force Base (AFB), CA; and (5) Modify NASA facilities for secure DOD operations. The Air Force, as the DOD executive agent, is responsible for the planning, development, integrated logistics support and activation activities necessary to achieve these objectives.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	(PE 64411F)	333,988	345,764	134,147		134,108	2,432,000
Missile Procurement	(PE 12449F)	192,991	137,872	24,127		403	1,039,300
Other Procurement	(PE 12449F)	26,527	16,152	2,276		9,114	122,800

The decrease in FY 1985 RDT&E funds is due to Congressional denial of funds. This will delay the completion of several facilities including the Payload Preparation Room, the Hazardous Waste Facility and the Oxidizer Loading Facility until significantly after the first launch from Vandenberg and increase the time required to recover from any problems encountered in the launch processing activities. The increase in FY 1986 RDT&E funds is for support of the Air Force Operational Test and Evaluation Center to assess the initial operational test flights of the Shuttle from Vandenberg AFB.

4. (U) OTHER APPROPRIATION FUNDS:* ($ in thousands)

Missile Procurement	(PE 12449F)	192,991	137,279	22,073	403	0	1,036,653
Other Procurement	(PE 12449F)	26,527	16,719	2,240	4,494	4,461	122,402
Military Construction	(PE 12449F)	46,500	16,360	0	0	3,921	566,160

* Does not include operational funding which is reported separately in PE 35171F, Space Launch Support

5. (U) RELATED ACTIVITIES: This program is directly related to, and paced by, the National Aeronautics and Space Administration (NASA) Space Shuttle development program. Under interagency agreements, NASA will fund for all Shuttle Orbiters, provide the general purpose launch and landing facilities at Kennedy Space Center (KSC), FL and perform Shuttle mission control at Johnson Space Center (JSC), Houston, TX. The Department of Defense (DOD) portion of the program will include the development of the Inertial Upper Stage (IUS), the acquisition and operation of Space Shuttle launch and landing facilities at Vandenberg Air Force Base (VAFB), and funding for the DOD security requirements levied on the NASA developed Space Transportation System (STS) elements. NASA/DOD coordination at all organizational levels assures that the STS will meet the needs of both agencies. DOD payload planning efforts are addressed by the DOD Space Shuttle User Committee which includes representatives of the Army, Navy, Air Force, Office of the Secretary of Defense, and Joint Chiefs of Staff. The Air Force Director of Space Systems and Command, Control, Communications chairs this body and also has the responsibility for research and development efforts involving Air Force payloads, expendable launch vehicles and the Shuttle program. Inertial Upper Stage (IUS) production, VAFB operation and maintenance and Shuttle flight charge paid to the NASA for Air Force users are funded under Program Element 35171F (Space Launch Support). IUS flight equipment and operation, and Shuttle flight charges for other DOD users are funded by the users' program elements. Related activities for near term utilization of the Space Shuttle sortie mode capabilities are being pursued by the Space Test Program under Program Element 63402F. The Air Force began construction in 1983 of a Consolidated Space Operations Center (CSOC) funded under Program Element 35130F, to eliminate the vulnerability represented by the single critical control nodes of the Satellite Test Center (payload control) and Johnson Space Center (Shuttle control).

6. (U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles Air Force Station (AFS), CA of the Air Force Systems Command is the development agency for the Air Force Space Shuttle activities. The Aerospace Corporation, El Segundo, CA provides Space Division with general systems engineering support. Martin Marietta (Denver), VAFB, CA, completed the contract for the detailed design and is the integrating contractor for the Vandenberg AFB Shuttle facilities and for development and procurement of necessary unique support equipment and software. The NASA is the procuring agent for all Vandenberg AFB support equipment and software common to both Kennedy Space Center, FL, and VAFB. The United States Army Corps of Engineers is the construction agent for all facilities at Vandenberg AFB. Various construction contractors are employed for the actual construction (through the Corps of Engineers). Lockheed Space Operations Company was awarded the Shuttle Processing Contractor contract and will be responsible for all Shuttle processing activities at KSC and Vandenberg AFB. Rockwell International, Downey, CA and United Space Boosters, Huntsville, AL provide expertise on the Orbiter and the Solid Rocket Boosters respectively in support of the Vandenberg AFB Shuttle facilities design and activation. Martin Marietta is also under contract to provide engineering services in support of payload integration activities. Boeing Aerospace Corporation, Seattle, WA was awarded the contract for IUS full scale development and is also performing spacecraft-to-IUS integration activities. TRW Systems, Redondo Beach, CA is supporting development of the secure Shuttle mission control capability at the Johnson and Kennedy Space Centers. International Business Machines, Houston, TX is under contract to evaluate specialized Orbiter flight software for DOD missions.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64411F, Space Shuttle

A. (U) Project Description: The Space Task Group, established by the President in 1969, recommended that a Space Transportation System (STS) be developed to provide more flexible and effective access to space at lower costs than current expendable launch vehicles. In January 1972 the President authorized the National Aeronautics and Space Administration (NASA) to proceed with the development of the reuseable Space Shuttle as a national means for transporting payloads to and from space. The STS consists of the Space Shuttle Vehicle which carries payloads to low earth orbit and returns to land on a runway; upper stages to transfer payloads from low earth orbit to higher orbits; and associated ground and airborne support systems. The Space Shuttle Vehicle consists of the Orbiter (the winged, recoverable spacecraft, the size of a DC-9), an External Tank containing fuel and oxidizer for the Orbiter's main engines, and a pair of recoverable Solid Rocket Boosters which provide initial boost acceleration for the vehicle. The reusable Orbiter carries the payload (spacecraft and, if required, upper stage) into orbit in its 15x60 foot payload bay. The system will have the capability to boost 30,500 pounds of payload to a near-polar (98°) orbit, or 65,000 pounds into an Easterly (28.5°) orbit. After reentry, the Orbiter lands on a runway using a high speed, unpowered approach. The Orbiter and Solid Rocket Boosters are recovered, refurbished, and reused. The facilities at the two launch bases Kennedy Space Center (KSC), FL and Vandenberg AFB, CA, accomplish the recovery, refurbishment, and reintegration of the major components of the Space Shuttle Vehicle to prepare it for its next launch. The NASA mission control center at Johnson Space Center (JSC) will be used for mission planning and control until the Department of Defense (DOD) acquires a dedicated capability, the Consolidated Space Operations Center (CSOC). The STS will be the primary launch system for DOD payloads.

(U) The Air Force participates in the Shuttle program to assure that critical national defense missions will continue to be effectively supported. Although the NASA is responsible overall for the STS, the Air Force defines DOD operations and support requirements and assesses the effect of Shuttle design changes on DOD national security missions. The Air Force addresses the unique DOD needs to assure the maximum operational utility of the expanded space mission capability offered by the Shuttle. In addition, the long term advantages of the Shuttle to the DOD appear to be substantial particularly in the areas of payload retrieval, on-orbit repair, assembly of very large structures in space, and the availability of an orbital test bed--modes of operation unavailable without the Shuttle.

(U) To minimize the operational impact of modifying DOD payloads and to make early effective use of the Shuttle, the DOD and the NASA agreed that the Air Force would develop an expendable upper stage for use with the Shuttle - this stage is called the Inertial Upper Stage (IUS). The IUS is used on the Shuttle by both the DOD and the NASA.

(U) The DOD has also agreed to acquire and operate the Space Shuttle launch and landing facilities at Vandenberg AFB, CA with an initial launch capability date of October 1985. This agreement was reached after an extensive study determined that DOD and NASA requirements could not be satisfied from one launch site, and that use of a second site

at Vandenberg AFB was necessary for polar orbit missions. The heavier near-polar missions cannot be accomplished from the Kennedy Space Center (KSC) since that would require overflight of the continental United States while sub-orbital and result in the large Shuttle external tank being released on a ballistic trajectory over the Sino-Soviet land mass for impact in the Indian Ocean.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The Inertial Upper Stage (IUS) full scale development effort continued with correction of the anomaly experienced on Space Shuttle Flight 6. The construction and activation of the Vandenberg AFB launch and landing site continued toward the October 1985 initial launch capability. Equipment installation and ground system testing for all major facilities continued. Construction began on the Hazardous Waste Disposal Facility, various physical and data processing security measures, and modifications to the launch pad to control ice buildup on the External Tank after propellant loading. Activation efforts for the launch capability continued, including the stacking of the Flight Verification Vehicle (a non-flight Space Shuttle) to test mechanical sequencies and fit, to train the processing crew, and conduct payload processing tests. Modifications for secure operations at Johnson (JSC), Kennedy (KSC), and Goddard (GSFC) Space Centers continued.

(2) (U) FY 1985 Program: The IUS full scale development will be completed with the implementation of modifications identified as a result of the first IUS on STS Flight 6. The construction and activation of the Vandenberg AFB launch and landing site will continue toward the October 1985 initial launch capability. Delivery and stacking of the Solid Rocket Boosters, External Tank, and Space Shuttle (OV-103) for the first flight will proceed. Other preflight activities and preparations will continue. Construction will include modifications to existing facilities for compatibility with the NASA Kennedy Space Center (KSC) configuration implementation of physical and data security, and modification for performance enhancements. Development of secure operations capability will continue at all facilities.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Vandenberg AFB launch and landing site development will reach initial launch capability and continue towards FY 1987 Full Operational Capability (FOC). The installation and checkout of additional equipment required to achieve the FOC will continue. Specifically, the capability to turnaround Orbiters after flight rather than have them processed at KSC and the installation of permanent support equipment instead of using portable equipment from Edwards AFB. The Department of Defense (DOD) secure operations capability will attain FOC. Cost estimates are derived from contractor estimates, National Aeronautics and Space Administration (NASA) experience at KSC and Air Force experience on similar efforts.

(4) (U) Program to Completion: Vandenberg AFB launch and landing site will be operational. NASA selected options for further thrust augmentation to achieve DOD specified performance will be incorporated. Primary mission control responsibility for DOD missions will transition to the Consolidated Space Operations Center (CSOC).

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Vandenberg Air Force Base Design Criteria Start	October 1975
(2) (U) Inertial Upper Stage Validation Phase Start	September 1976
(3) (U) Inertial Upper Stage Full Scale Development Start	April 1978
(4) (U) Vandenberg Air Force Base Construction Start	January 1979
(5) (U) Inertial Upper Stage Initial Launch Capability (Titan III)	October 1982
(6) (U) Inertial Upper Stage Initial Launch (Shuttle)	April 1983
(7) (U) Johnson Space Center Controlled Mode Initial Operational Capability	August 1983
(8) (U) Kennedy Space Center Shuttle Payload Integration Facility Operational Capability	June 1983
(9) (U) Goddard Space Flight Center Security Modification Initial Capability	February 1984
(10) (U) Vandenberg Air Force Base Initial Operational Capability	October 1985
(11) (U) Vandenberg Air Force Base Thrust-Augmented Launch Capability	January 1986
(12) (U) Vandenberg Air Force Base Full Operational Capability	October 1987

Budget Activity: 6, Defense-Wide Mission Support
Program Element: 64411F, Space Shuttle

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The National Aeronautics and Space Administration (NASA) and the Air Force are each developing, acquiring and operating a portion of the common-use hardware and facilities of the Space Shuttle program. NASA has the development and operation responsibilities for the Space Shuttle Vehicle, the East Coast Shuttle launch and landing facilities at Kennedy Space Center, FL and the Mission Control Center at Johnson Space Center, TX. The Department of Defense developed the Inertial Upper Stage for East Coast launches and is developing and will operate the West Coast Shuttle launch and landing facilities at Vandenberg Air Force Base, CA. The Air Force is also funding those modifications to the existing NASA facilities and equipment required to allow classified operations to be conducted (i.e., "Controlled Mode" at Johnson, Kennedy and Goddard Space Centers). The Air Force is planning a Consolidated Space Operations Center funded under PE 35130F with an FY 1987 operational capability to augment and backup the present satellite control capabilities of the Satellite Control Facility, Sunnyvale, CA and to provide a dedicated Department of Defense Shuttle control capability, with an initial operational capability in FY 1989. Air Force test and evaluation activities are being conducted as a combined Development Test and Evaluation/Operational Test and Evaluation program.

(U) Department of Defense Assessment of National Aeronautics and Space Administration Segments: The Air Force Systems Command--with Air Force Operational Test and Evaluation Center participation and support from other Air Force agencies--will assess the capability (performance and availability) of the NASA developed segments to support Department of Defense requirements. This evaluation activity consists primarily of monitoring and evaluating major Space Transportation System (STS) processing events conducted by the NASA.

(U) Air Force test participation began with monitoring of the Approach and Landing Tests conducted at Edwards Air Force Base, CA from February 1977 to March 1978. These tests successfully demonstrated the low speed flying and manual landing characteristics of the Orbiter vehicle as well as the adequacy of the ferry capability of a modified Boeing 747 Shuttle Carrier Aircraft. Subsequently, the Mated Vertical Ground Vibration Test, conducted at the Marshall Space Flight Center from March 1978 to February 1979, was monitored. This test satisfactorily provided the required information to validate the analytical model used to design and verify the structural capability of the Space Shuttle Vehicle and, subsequently, update the predictive models used to calculate the environments seen by Department of Defense payloads while in the Shuttle payload bay.

(U) Progress of the Space Shuttle Main Engine development has been continuously monitored since January 1978 due to its critical role in Space Shuttle Vehicle performance and schedule. The engine is certified for operations at 100% (Rated Power Level) which was adequate for the test program flights. The engine has performed at Full Power Level (109% of Rated Power Level); however, hardware design and reliability problems caused major program delays. The Main Propulsion Test at the National Space Technology Laboratories began in April 1978 and completed all test objectives

vital for the first manned orbital flight in January 1981. Testing at Full Power Level was terminated prior to the fourth and final certification cycle. The engines are now certified for Full Power Level (109%); however, due to the early termination of testing, the engines can only be used at the Full Power Level (109%) for one or two flights before the turbopumps need to be refurbished. Had the entire certification program been completed the engines could have been used on 7 or 8 missions before requiring refurbishment.

(U) The Shuttle Avionics Integration Laboratory at Johnson Space Center is used to verify avionics hardware and software compatibility and to provide confidence in the ability of these subsystems to successfully perform the flight sequences. This ongoing program started in March 1979 and has been successful in identifying and correcting a number of hardware and software configuration discrepancies. The Air Force will continue monitoring the test progress and results from this activity.

(U) The Orbital Flight Test program, completed with the flight of STS-4 in July 1982, provided data for the Air Force participation in formal National Aeronautics and Space Administration verification activities. Since all Department of Defense concerns were not answered during the Orbital Flight Tests, Air Force test activity will continue to include operational flights until all critical DOD issues are adequately resolved.

(U) Inertial Upper Stage (IUS) Test Program: A Defense Systems Acquisition Review Council Milestone II review of the IUS program was held in March 1978 and approved proceeding with full scale development. The Boeing Aerospace Company is on contract for the full scale development phase. The Defense Systems Acquisition Review Council also approved production of an initial quantity of nine IUS vehicles (subsequently reduced to eight; four STS configured and four Titan 34D configured), to meet planned flight schedules for both NASA and DOD. Because of the high cost and immediate operational need of Department of Defense developed STS flight hardware (there were no dedicated test launches of an IUS), a combined Development Test and Evaluation/Operational Test and Evaluation program was conducted. The Inertial Upper Stage test and evaluation focused on system performance, reliability, maintainability and compatibility with the STS.

(U) The most critical IUS development items were the avionics components, flight software and the long-duration burn solid rocket motors.

(U) Vehicle component qualification testing of the IUS began in August 1979 and was completed in mid-1982. The primary problem affecting the avionics system was the unavailability of high reliability space qualified electronic piece parts.

(U) In the IUS software area, the flight software was developed and tested at the Boeing Aerospace Corporation facility in Kent, WA. The Titan flight software was designed, coded and tested at Boeing. Martin Marietta Corporation

performed the independent verification and validation. The mission data loads were designed for the first three Department of Defense spacecraft and for the first National Aeronautics and Space Administration-sponsored Tracking and Data Relay Satellite (TDRS). Development, validation and verification testing of the operational software for the Titan configuration Inertial Upper Stage (IUS) was completed in July 1982. The Shuttle configured software completed validation and verification testing in early 1983.

(U) Propulsion system development testing has been completed. Seven solid rocket motor cases were burst tested and four cases were skirt tested. IUS motor case development and verification have been successfully completed. Motor case efficiency is at the state-of-the-art level and case burst data shows little scatter. Skirt ultimate loads have been demonstrated four times. In addition to the four full scale nozzle firing tests, six large and seven small IUS development motors (including one spin motor) have been successfully fired at the Arnold Engineering and Development Center, TN. Two motor firings included the Extendable Exit Cone (deployed prior to the test). These firings completed the motor development program. In the qualification program, one burst test and twelve additional motor (six small and six large) firings were conducted. The firings began in November 1981 with the successful firing of a large motor. The qualification program for the Titan configuration was completed in July 1982 and in September 1982 for the Shuttle configuration.

(U) The first flight vehicle (Titan configuration) completed acceptance testing in October 1981 and was successfully launched on a Titan 34D in October 1982 from Cape Canaveral Air Force Station. The second flight vehicle (Shuttle configuration) was launched on STS-6 in April 1983 and failed to place the NASA payload (TDRS A) in the correct orbit. The failure investigation centered on the second stage nozzle techroll seal, which was determined to be the most likely cause of the malfunction. The next flight of the IUS is expected to occur in January 1985.

(U) Vandenberg Air Force Base Ground Support System Testing: The Martin Marietta Aerospace Company is on contract to verify the system requirements, equipment, and facilities specification criteria for the Vandenberg Air Force Base launch and landing site. Facilities construction and equipment installation is in progress with Martin as the prime contractor. Ground Support System testing will focus on ground processing of the Space Shuttle Vehicles, ground operations, supportability, Air Force manpower/resources, and contractor support.

2. (U) Operational Test and Evaluation (OT&E): Air Force test activities are being conducted on the Department of Defense (DOD) segments as a combined Development Test and Evaluation/Operational Test and Evaluation (DT&E/OT&E) program. The Air Force Operational Test and Evaluation Center (AFOTEC) independently evaluates and reports on the DOD segments, participates with the Air Force Systems Command (AFSC) in National Aeronautics and Space Administration (NASA) verification activities, and works with AFSC to provide an overall systems level assessment of the STS capability to meet DOD requirements.

(U) DOD Assessment of NASA Segments: AFOTEC is participating with AFSC in monitoring and observing the NASA test

activity and assessing the capabilities of the Space Transportation System (STS). This evaluation activity primarily consists of monitoring NASA STS verification efforts, conducted at Kennedy Space Center (KSC), Florida; Johnson Space Center (JSC), Texas; and Edwards AFB (EAFB), California. The primary focus of USAF involvement in NASA activity is to determine the availability and the capability of the STS to support DOD requirements. All KSC ground flow activity and launch operations, JSC flight operations, and landing operations at both EAFB and White Sands, New Mexico, were observed for STS-1 through STS-8 by a combined AFOTEC-AFSC test team and test reports were published on all significant operations. An Initial Shuttle Assessment Report (ISAR), covering the first six STS flights, was published in June 1983. An addendum to the ISAR, the STS survivability report, was published in October 1983. The formal joint AFSC/AFOTEC assessment of the NASA segments was completed in October 1984 with publication of the Shuttle Assessment Report (SAR) which covers STS flights through STS-14. The assessment indicates that the STS will meet the majority of DOD requirements However, there is a major concern that the maximum payload launch rate from Vandenberg will not be achieved.

(U) Inertial Upper Stage (IUS) Test Program: IUS T&E focused on system performance, reliability and maintainability, and compatibility with the STS and payloads. The actual buildup and checkout of the IUS is handled by contractor personnel. AFOTEC provided an independent evaluation and assessment of the IUS system in the IUS Final Report, March 1984. AFOTEC and AFSC conducted a combined DT&E/OT&E program by observing IUS factory testing, pathfinder test vehicle, and flight hardware processing at Cape Canaveral Air Force Station (CCAFS). Analysis indicates that the IUS is acceptable and will meet the major operational system requirements. However, the significant operational issue remaining is the ability of the IUS to consistently and reliably perform its mission.

(U) Vandenberg AFB (VAFB) Ground Support System (GSS) Test Program: VAFB GSS testing focuses on compatibility of ground processing equipment with the space shuttle vehicle, ground operations, supportability, contractor support, and USAF manpower/resources. Much of the ground processing data obtained at KSC will be applicable to VAFB due to the similarity of STS equipment, facilities, procedures, and support contractor. The OT&E test team will initially be located at Cape Canaveral AFS to begin collecting data as a baseline for the GSS evaluation. The test team started transitioning to VAFB in FY 1984. The GSS evaluation will continue through the VAFB full operational capability scheduled for October 1987. AFOTEC will provide an independent evaluation and assessment of the VAFB GSS.

(U) Operations Capability Development: AFOTEC participates in testing of the other DOD segments and provides independent assessments of operational suitability and effectiveness.

(U) The following OT&E reports have been published:

(1) Inertial Upper Stage (IUS) OT&E, October 1980 to December 1981, Status Report, dated April 1982.
(2) Initial Shuttle Assessment Report (ISAR), June 1983.
(3) STS Survivability Report, October 1983.
(4) IUS Final Report, March 1984.

Budget Activity: 6, Defense-Wide Mission Support
Program Element: 64411F, Space Shuttle

3. (U) System Characteristics: The key performance parameters of the National Aeronautics and Space Administration and Department of Defense developed segments are shown below:

NASA SEGMENT - SPACE SHUTTLE VEHICLE

ITEM	OBJECTIVE	CURRENT ESTIMATE	DEMONSTRATED	REMARKS
Payload to 160 nautical miles 28.5° inclination	65,000 pounds	65,000 pounds *	32,700 pounds	Baseline Reference Mission 1
Payload to 150 nautical miles 98° inclination	32,000 pounds	30,500 pounds **		Baseline Reference Mission 4
Payload to Geosynchronous (Shuttle-Centaur G)	10,000 pounds	10,000 pounds		

* - Mature OV-104 Performance (requires improvements in Space Shuttle Main Engine thrust, Space Shuttle Vehicle weight and Trans-Atlantic Abort and Landing Sites)

** - Mature OV-103 Performance (requires Filament Wound Cases for the Solid Rocket Boosters, and improvements in Space Shuttle Main Engines and Space Shuttle Vehicle weight)

Budget Activity: 6, Defense-Wide Mission Support
Program Element: 64411F, Space Shuttle

AIR FORCE SEGMENT - INERTIAL UPPER STAGE (IUS)

ITEM	OBJECTIVE	CURRENT ESTIMATE	DEMONSTRATED	REMARKS
Payload to Geosynchronous (Shuttle Version)	5,000 pounds	5,087 pounds	*	With Extendable Exit Cone
Payload to Geosynchronous (Titan Version)	4,000 pounds	4,040 pounds	3,871 pounds	With Extendable Exit Cone
Accuracies				
Position	± 92 nautical miles	± 44 nautical miles		Shuttle Version at Geosynchronous altitude
Velocity	± 78 feet/second	± 46 feet/second	*	
Inclination	± 0.12°	± 0.073°		

* To be demonstrated in January 1985.

Budget Activity: 6, Defense-Wide Mission Support
Program Element: 64411F, Space Shuttle

4. (U) Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

Event	Planned Activity	Actual Date	Remarks
STS-14	June 1984	August 1984	1st launch of orbiter "Discovery" delayed due to Space Shuttle Main Engine problems.

T&E Activity (Next 12 Months)

Event	Planned Date	Remarks
STS-20	January 1985	1st launch of DOD payload in the STS operational era.
STS-1V	January 1986	1st VAFB launch.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64609F
DOD Mission Area: 475 - Central Supply and Maintenance

Title: Logistics Technology for Weapon Systems
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,845	7,585	6,750	11,106	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force has long recognized the need for a mechanism by which support technologies that promise high payoff in terms of increased readiness and lower life cycle weapons costs can be accelerated and transitioned into fielded systems. This program element fills that need by lowering the risk of accelerated integration through full-scale demonstrations. To be considered for funding by this element, three key criteria must be met: (1) the technology must be generic; that is, potentially applicable to several weapon system developments; (2) be of sufficiently high risk to prevent its inclusion in a specific weapon development program due to adverse cost and schedule impact; and, (3) be identified with a specific weapon program to be used as an off-line weapon program. If any of these criteria are not met, the project will not be funded within this element and is more appropriately funded within a weapon development line. Candidates that are funded will not be continued beyond the point at which risk has been lowered such that integration into a specific program becomes the responsibility of that program. To manage this effort, the Air Force will fund through this element the Weapon System Support Development (WSSD) Program Office. This office will annually validate from among competing candidates those projects eligible for demonstration funding. A senior officer steering group will ratify final selections. Focus will be on transition of support technologies from Air Force laboratories or government sponsored research (including universities and industry) with high potential for improving weapon support by demonstration on and integration into programs currently in advanced or full-scale development and which can clearly lead to common/standardized equipment for several systems. PE 64609F and PE 63106F, Logistics R&D Requirements, which is designed to accommodate multi-laboratory support technologies not yet mature enough for advanced or full-scale development, are the cornerstones of the Air Force's RDT&E efforts to accelerate and transition support technologies to enhance readiness and sustainability of future weapon systems.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	4,950	7,585	15,154		Continuing	N/A

FY 1984 reduction by Air Force to provide funds to cover reprogramming actions and properly align funding profile for unprojected start up delays. FY 1986 reduction by Air Force to adjust funding levels to be consistent with DOD direction.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The efforts undertaken in this program currently interface with PE 64231F, C-17 program; PE 27423F, Enhanced Joint Tactical Information Distribution System; PE 64226F, B-1B program; and PE 64312F, Intercontinental Ballistic Missile Modernization.

6. (U) WORK PERFORMED BY: Overall management of this effort done by Air Force Systems Command, Andrews AFB, MD.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 64609F, Logistics Technology for Weapon Systems

A. (U) Project Description: In Dec 78, the Secretary of the Air Force directed creation of a logistics research program. A staff study team provided recommendations in Oct 79 on the organizational structure and concept of operations required to initiate such a program. Air Force, with resource support from the Air Force Logistics Command (AFLC), subsequently created the Air Force Coordinating Office for Logistics Research (AFCOLR) in Sept 80. In a joint memo dated 3 Dec 80, the Secretary of Defense directed increased emphasis on logistics oriented R&D programs by each of the Services. The Services were tasked to develop hardware techniques, system design approaches, and new support concepts which reduce the support burden of our weapon systems. An internal review of the USAF logistics R&D activity indicated potential for improvement in our efforts to transition promising logistics technologies from the laboratory into weapon systems. The Weapon System Support Development (WSSD) program office was established. The WSSD selects, for subsequent approval by a review group, candidate laboratory technologies with high payoff potential for reducing the weapon systems support burden and funds the validation efforts necessary to prepare the approved projects for transition into weapon systems. These validation projects will be conducted in parallel with, but separate from, the baseline System Program Office (SPO) efforts. Successful projects will subsequently be approved for integration into the primary weapon system by the recipient SPO as a Preplanned Product Improvement (P^3I) program action funded within the system line. This procedure will ensure timely demonstration of technology applications for improving weapon system supportability without initial dependence on the recipient weapon system development program.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The FY 1984 WSSD program office submission of projects for FY 1984 and beyond established the baseline FY 1984 program. A Multiple Use Frequency Standard began development for integration into the Air Force inventory as a generic time standard for embedded clocks. The Enhanced Joint Tactical Information Distribution System is the identified test and evaluation platform. An Onboard Inert Gas Generator (OBIGGS) began development as an autonomous system to replace foam and liquid-nitrogen inerting systems of fuel tanks on aircraft. The C-17 is the candidate aircraft for integration. The C-130 and C-5B were identified as test-bed platforms for evaluation and qualification. Future projects were identified and reviewed for approval by the WSSD office and senior officer steering group. The low maintenance hydraulic actuator and pump mechanism project was

deleted as a FY 1984 project due to a conflict of interest with another program. The Multiple Use Frequency Standard has a projected return on investment of 10 to 1 over a 10 year investment period. The OBIGGS has a projected return on investment of 10 to 1 over a 20 year period.

(2) (U) FY 1985 Program: The work on Multiple Use Frequency Standard and Onboard Inert Gas Generator (OBIGGS) will continue. Review of candidate projects by the Weapon System Support Development (WSSD) steering group in late FY 1984 identified the B-1B Central Integrated Test System, Expert Parameter System (CEPS) as a project for funding in FY 1985 along with the Advanced Rocket Nozzle Inspection System (ARNIS). That review also deleted the Multi-functional Intergrated Power Unit and the Modular Automatic Test Equipment projects from the FY 1985 program based on the established criteria for funding projects. The B-1B CEPS will provide artificial intelligence technology to analyze data collected by the B-1B Central Integrated Test System. CEPS is an accelerated effort to apply technology being developed by the Generic Integrated Maintenance Diagnostics System. The ARNIS project will develop a low energy x-ray computed tomography for testing carbon-carbon rocket nozzles to be used by the Small Intercontinental Ballistic Missile. New candidates will be reviewed for FY 1986 starts by the WSSD steering group. This review may realign and/or define new projects that will replace currently defined FY 1986 project starts. Any decision to make a change to the FY 1986 program is again predicated on the defined program criteria established for project funding.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Work on Multiple Use Frequency Standard and OBIGGS will continue. Multiple Use Frequency Standard is scheduled for completion. The B-1B CEPS and ARNIS projects will continue. New projects currently under consideration for the FY 1986 program include the Multi-Functional Integrated Power Unit, a combined OBIGGS/OBOGS (Onboard Oxygen Generating System) project, a Nuclear Hardness Maintenance project, application of advanced computer technology to maintenance training simulators, and application of advanced technology for Air Base Survivability. Initiation of these projects will be determined by the WSSD steering group's FY 1985 review of recommended FY 1986 new project starts. Determination to begin any new project will be predicated on the program criteria for project funding. This criteria considers generic application of the technology, the programmatic risk to a development program if taken on by that program as an additional task within its current funding resources, and agreement by a specific development program to undertake a WSSD aproved project as an off-line effort. In addition, consideration of such factors as projected return on investment, new candidates identified in the FY 1985 project review of the FY 1986 program, and availability of program funds will be folded into the final project funding decision. This review process is designed to obtain the best use of program resources to introduce only the most promising support technologies to weapon systems in the development arena.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64707F   Title: Weather Systems
DOD Mission Area: #420 - Global Military Environmental Support   Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		9,313	7,283	13,078	7,590	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element provides engineering development of weather systems that, when fielded, will eliminate critical shortfalls in weather support to Air Force and Army operations. The increasing emphasis on Air Force operations during night and bad weather makes the rapid and accurate determination of weather conditions of increasing importance. Requirements for improved weather support have expanded much faster than the capabilities to support them. This program provides several efforts to upgrade weather support to meet these requirements. Efforts include development of equipment to process, display, and disseminate weather data and forecasts to fixed-base and tactical weather stations; development of a doppler weather radar, and development of the capability to support electro-optical weapon systems on the battlefield. The following efforts are included:

(U) Through existing technology in minicomputers, displays, and communications equipment, the development and fielding of the Automated Weather Distribution System (AWDS) will partially automate Air Force weather stations around the world to significantly improve timeliness and accuracy of weather intelligence.

(U) Development of the joint Department of Defense/Department of Commerce/Department of Transportation doppler weather radar called Next Generation Weather Radar (NEXRAD) will, for the first time, allow direct measurement of winds within storm systems. Such capability is vital to forecasting tornadoes, damaging winds, and damaging hail. NEXRAD will dramatically increase our severe weather warning capability.

(U) Battlefield Weather Observation and Forecast System (BWOFS): In the past, weather support to combat operations has emphasized those weather parameters sensible to man. Many current and developing electro-optical weapons systems are affected by weather in totally different ways than man, i.e., visibility for a human could be unlimited, yet an infrared sensor would not lock onto a target unless it can detect temperature different than than its background. Conversely infrared sensors work well at night when man can see nothing. This program provides engineering development of the capability to measure critical weather elements in enemy territories and the capability of translating these data into meaningful support to electro-optical weapons systems.

Program Element: #64707F Title: Weather Systems
DOD Mission Area: #420 - Global Military Environmental Support Budget Activity: #6 - Defense-Wide Mission Support

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	8,030	8,283	9,126		Continuing	N/A

EXPLANATION: (U) The FY 1985 Continuing Resolution reduced the program $1 million. Without programming the Air Force will be unable to provide its funding share to the joint Next Generation Weather Radar (NEXRAD) program. In FY 1986 funds were added to complete the prototype development of the Automated Weather Distribution System (AWDS). These funds are required to fund the Air Force share of the joint United States-Canada funding of the AWDS development contract. The additional funds became necessary when protracted negotiations with the Canadian government extended prototype development into FY 1986. Funds were added in FY 1984 to fully fund the Air Force share of NEXRAD.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement (PE 35111F):						
NEXRAD						
Funds			4,171	24,095	136,139	160,234
Complete Radar Quantities			1	3	45	49
User Set Quantities			1	29	40	94
AWDS						
Funds				32,992	118,136	151,128
Fixed Base Quantities				40	125	165
Transportable Quantities					13	19
Military Construction (PE 35111F):						
Funds (NEXRAD only)				2,917	16,510	19,427

5. (U) RELATED ACTIVITIES: PE 63707F, Weather Systems (Advanced Development), accomplishes advanced development projects whose results support PE 64707F. Funds for procurement of systems developed in PE 64707F are included in PE 35111F, Weather Services.

6. (U) WORK PERFORMED BY: AWDS development is managed by Electronic Systems Division, Hanscom Air Force Base, MA. It is being acquired under the Joint United States-Canada Defense Production and Development Sharing Program. The prime contractor is the Canadian Commercial Corporation, Ottawa, Canada. MacDonald, Dettwiler & Associates, Ltd, Richmond British Columbia is the prime subcontractor. Development of the NEXRAD is managed by the Joint System

Richmond British Columbia is the prime subcontractor. Development of the NEXRAD is managed by the Joint System Program Office within the National Weather Service, National Oceanic and Atmospheric Administration, Department of Commerce. Competing contractors are Raytheon Co., Wayland, MA, and Sperry Corporation, Defense Electronics, Greatneck, NY.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 64707F, Weather Systems

A. (U) Project Description: The increasing emphasis on Air Force operations during night and bad weather makes the rapid and accurate determination of weather conditions of increasing importance. This project funds development of equipment and techniques for a badly needed upgrade of Air Force Air Weather Service support. Such support will make weather intelligence a force multiplier on the battlefield and will provide improved resource protection through greatly improved severe storm detection and warning. The following are addressed:

(U) Automated Weather Distribution System (AWDS) will automate most weather data handling tasks within each Air Weather Service weather station at major Air Force Bases, some Army installations and Air Force tactical facilities. It will replace 1950's technology equipment currently in use. AWDS will use a minicomputer to accelerate data handling, incorporate more efficient forecast preparation techniques, and speed dissemination of precise and up-to-date weather intelligence. Once observations, forecasts and weather warnings become available, the system will display them to the forecasters and local users. A unique aspect of AWDS is its acquisition through the Joint United States-Canada Production and Development Sharing Program. As such, the Canadian Government will fund half of the development contract.

(U) Next Generation Weather Radar (NEXRAD), a joint Departments of Defense/Commerce/Transportation development and procurement effort, will provide a greatly improved storm detection and warning capability. This radar will detect severe surface wind, hail, tornadoes and turbulence using doppler techniques; automate thunderstorm tracking; accelerate severe thunderstorms identification; and improve warning accuracy and timeliness through use of interactive warning preparation techniques. It will double radar detection of severe thunderstorms, cut the severe thunderstorm warning false alarm rate from 75 percent to 25 percent and provide an average tornado warning time of 23 minutes. Currently this warning time is zero.

(U) Battlefield Weather Observation and Forecast System (BWOFS) is currently in advanced development. It will begin transition to engineering development in FY 1985. The advanced development effort will provide a rudimentary battlefield capability to support electro-optical weapons systems with slow, labor intensive techniques using hand held calculators, charts and tables. The engineering development program will develop the capability to collect critical weather data from behind enemy lines using an unmanned vehicle and develop automated weather forecast techniques specifically tailored to the electro-optical weapons systems. This will vastly increase timeliness and accuracy of weather support to Air Force combat operations involving the employment of electro-optical weapons systems.

Program Element: <u>#64707F</u> Title: <u>Weather Systems</u>
DOD Mission Area: <u>#420 - Global Military Environmental Support</u> Budget Activity: <u>#6 - Defense-Wide Mission Support</u>

B. (U) <u>Program Accomplishments and Future Efforts:</u>

(1) (U) <u>FY 1984 Accomplishments:</u> Automated Weather Distribution System (AWDS): Full Scale Development (FSD) contract was set in March; Systems Requirements Review was accomplished in May; and the Systems Design Review was accomplished in June. An 18 month software development effort was initiated in July. Next Generation Weather Radar (NEXRAD): High risk software and hardware prototype development was completed successfully in April by two competing contractors. Both were retained through the Validation Phase to develop full scale prototypes to be used in operational test and evaluation.

(2) (U) <u>FY 1985 Program:</u> AWDS: The most significant element of AWDS development is software. While software development began in FY 1984, the largest share of the software will be written in FY 1985. Hardware for both the fixed base and transportable prototypes will be selected and integrated, and completed software will be incorporated. NEXRAD: FY 1985 is the principal year for NEXRAD development; prototype hardware and software will be developed throughout the year with completion scheduled for early 1986. Battlefield Weather Observation and Forecast System (BWOFS): Definition of specifications and operational concepts will begin for the forecast system.

(3) (U) <u>FY 1986 Planned Program and Basis for FY 1986 RDT&E Request:</u> Both AWDS and NEXRAD are joint programs, AWDS with the Canadian Government and NEXRAD with the Departments of Commerce and Transportation. The FY 86 request funds the Air Force share of the last major year of both development programs. AWDS: Fixed base and transportabl prototypes will be delivered by the contractor. Development Test and Evaluation (DT&E) will be completed and Initial Operational Test and Evaluation (IOT&E) will begin. NEXRAD: Prototype systems will be delivered by both contractors; IOT&E will be completed; and one contractor will be selected to begin limited production. BWOFS: Specification for the forecast system will be completed and a request for proposal for the Full Scale Development for the forecast system will be issued. The effort will be to write software and integrate it into off-the-shelf hardware to develop a fully logistically supportable system for providing weather forecasts tailored to specific weapons on the battlefield.

(4) (U) <u>Program to Completion:</u> This is a continuing program.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	NEXRAD* Request for Proposal for Prototype development	October 1982
(2)	(U)	AWDS** Request for Proposal for Prototype development	February 1983
(3)	(U)	NEXRAD Contract Award	June 1983
(4)	(U)	AWDS Contract Award	March 1984
(5)	(U)	NEXRAD Initial Test and Evaluation begins	1986
(6)	(U)	AWDS Initial Test and Evaluation begins	1986
(7)	(U)	Battlefield Weather Forecast System Contract Award	1987
(8)	(U)	AWDS Initial Operation	1988
(9)	(U)	NEXRAD Initial Operation (for the Department of Defense)	1988
(10)	(U)	Battlefield Weather Observation System Contract Award	1989
(11)	(U)	Battlefield Weather Forecast System Initial Operation	1989

* Next Generation Weather Radar
** Automated Weather Distribution System

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64735F
DOD Mission Area: 454 - Other Test and Evaluation Support

Title: Range Improvement
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		17,716	15,552	62,166	82,834	Continuing	N/A
2152	Mission/Engineering Support	3,300	3,600	3,600	3,700	Continuing	N/A
2286	Range Equipment	14,416	11,952	19,269	19,892	Continuing	N/A
6510*	Flight Test Simulators	(15,992)	(29,444)	39,297	59,242	Continuing	N/A

* Transferred from PE 64755F in FY 86. Project funding in parentheses for FY 84 and 85 is non additive in PE 64735F.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Wartime experience has shown that a disproportionate number of combat losses occur during an aircrew's first ten combat missions. There is a continuing requirement to reduce those losses by more realistic weapon system testing, aircrew training and tactics development. The increasing cost of modern weapon systems also mandates that we attain the most effective use of our test and training resources. This program contributes to the qualitative improvement of our combat forces by developing instrumentation and threat simulator systems to increase the effectiveness of Development and Operational Testing, training, and large scale exercises worldwide.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	17,864	16,771	35,307	Continuing	N/A
Aircraft Procurement (PE 27429F)*	7,800	21,700	15,200	Continuing	N/A
Other Procurement (PE 27429F)*	50,219	70,794	87,991	Continuing	N/A
Other Procurement (PE 11897F)*	20,300	41,100	52,700	Continuing	N/A

* Includes spares funding

EXPLANATION: (U) Project 6510 was transferred from PE 64755F, Improved Capability for Development Test and Evaluation, to PE 64735F in order to consolidate development of all threat simulators in one program element. This program attempts to acquire the most realistic development and operational test and evaluation (D/OT&E), aircrew training and tactics development threat scenario possible at the lowest cost. To accomplish this, emphasis was placed

on procuring fewer expensive emitter-receiver-processor simulators and a larger number of low-cost emitter-only systems. This change in concept necessitated conversion of $15.3M of R&D funds to procurement funds within the program element in order to purchase the off-the-shelf emitter hardware. In addition, $10.0M in R&D funds has been added to the program in FY 1986 to acquire simulators of two of the newest, most advanced Soviet threat radars systems for use during development and operational test and evaluation (D/OT&E).

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement (PE 27429F):						
Funds*	7,800	21,700	18,100	9,900	Continuing	N/A
Quantity	N/A					
Other Procurement (PE 27429F):						
Funds*	44,786	57,429	65,906	88,252	Continuing	N/A
Quantity	N/A					
Other Procurement (PE 11897F):						
Funds *	19,632	32,015	32,446	84,124	Continuing	N/A
Quantity	N/A					

* Does not include spares funding

5. (U) RELATED ACTIVITIES: Not Applicable.

6. (U) WORK PERFORMED BY: This program is managed by the Armament Division, Eglin AFB, FL. The major contractor for Project 2152 is a Systems Engineering and Technical Assistance (SETA) contractor, Bell Technical Operations/TEXTRON. Major contractors in Project 2286 include General Dynamics Corp, Ft. Worth, TX, AN/MST-T1 - Multiple Threat Emitter System; Metric Corp, Ft. Walton Beach, FL, AN/MPQ-T3 - Multiple Threat Emitter; Martin-Marietta, Denver, CO, AN/MSR-T4 - Electronic Warfare Signal Analyzer; Whittaker Corp, Chatsworth, CA, AN/MSQ-T43 - Modular Threat Emitter; and American Electronics Laboratories, Lansdale, PA, AN/MLQ-T4 - Ground Jammer.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2152, Mission/Engineering Support. This project provides the basic operating capital, system software acquisition and systems engineering support for the Range Improvement Program. Basic operating support includes temporary duty costs, equipment and supplies. Software acquisition provides research and development funds

for project software development. Engineering support provides technical evaluations, documentation and development tasks which improve the simulated operational threat environment, instrumentation and range support equipment. Most of this effort is currently being accomplished by the Systems Engineering and Technical Assistance (SETA) contractor. In FY 1984 this project provided range safety, computer and cost estimating support, travel, training, supplies and equipment and basic operating capital for the Range Improvement Program. The SETA contractor was required to conduct engineering, management, and related studies; develop assessments and analyses; perform system engineering; formulate specifications; write statements of work; and perform related work to accomplish these tasks. In FY 1985 this project will continue to provide range safety, computer and cost estimating support, travel, training, supplies and basic operating capital for the program. The SETA contractor will provide continuing engineering support, conduct studies, and perform assessments and analyses. I FY 1986 this project will continue to provide the basic operating capital, system software acquisition and systems engineering support for the Range Improvement Program.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2286, Range Equipment

A. (U) Project Description: This project develops and procures various electronics, telecommunications and instrumentation equipment to enhance readiness by more realistically simulating the combat environment and providing more accurate and complete data for training, testing, and evaluation. This project develops simulators designed to replicate enemy surface-to-air missile fire control radars, anti-aircraft artillery radars, early warning and acquisition radars, jamming equipment, Identification Friend or Foe (IFF) systems, and air defense command and control systems. It provides for development efforts necessary to observe, measure, record, and control aircraft, ground based threat systems, and other functional subsystems during test and training activities on Operational Test and Evaluation and training ranges.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: FY 1984 funds were used to start development of the Red Flag Measurement and Debriefing System (RFMDS) which combines three Nellis AFB, NV, range upgrade tasks into one project. (Aircrew Debriefing System (ADS), Video Processing and Edit System (VPES) and Range Measuring System (RMS)). Development continued on the AN/MPS-TYY the AN/MPS-38 the Air Combat Maneuvering Instrumentation (ACMI) missile simulation software and the Ground Controlled Intercept (GCI) Command and Control system Work also continued on adding more capability to the AN/MPQ-T3 Multiple Threat Emitter and the AN/MSR-T4 Electronic Warfare signal analyzer systems. Modifications to the Advanced Range Instrumentation Aircraft and development of the AN/MLQ-T4V Ground Jammer to were completed. Additional software for the Gulf Range Drone Control Upgrade System was developed and work was begun to design the Airborne Platform/Telemetry Relay System

to be used to relay over-the-horizon telemetry and communications during air-to-air missile firings in the Gulf of Mexico. Development also continued on the On Board Electronic Warfare System (OBEWS), a pod contained system to provide electronic warfare training for our aircrews without requiring a ground electronic warfare range.

(2) FY 1985 Program: FY 1985 funds will continue development of the Red Flag Measurement and Debriefing System software, the Gulf Range Drone Control Upgrade System software and OBEWS. The Airborne Platform/Telemetry Relay System design, the Tyndall AFB, FL, Range Control Facility and the Ground Controlled Intercept (GCI) Command and Control system development will be completed. Development of the AN/MPS-TYY the AN/MPS-38 the AN/MSR-T4 Electronic Warfare signal analyzer and the AN/MPQ-T3 Multiple Threat Emitter will also be completed. Development effort will continue on enhancing Air Combat Maneuvering Instrumentation (ACMI) capabilities by adding a new missile simulation and investigating use of the Navstar Gobal Positioning System (GPS). Development of the Strategic Training Range Complex continues and a comprehensive upgrade of the Spadeadam, UK, range through the addition of the Spadeadam Aircrew Debriefing System will also begin.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 funds will complete development on the Airborne Platform/Telemetry Relay System and the Gulf Range Drone Control Upgrade System. Funds will be used to continue improvement of ACMI/Aircraft interfaces and evaluate use of the NAVSTAR GPS on ACMI ranges. The Strategic Training Range Complex development program, a capability enhancement to the AN/MPQ-T3 Multiple Threat Emitter and OBEWS development will continue. Development of the Missile End Game Scoring System to instrument the Gulf Range for data acquisition in the intercept phase of air-to-air missile firings against airborne targets will begin. Development will also begin on the Crow Valley Measurement and Debriefing System to improve that range's communications, data transfer and range command and control and provide a capability similar to the Nellis AFB, NV, Red Flag Measurement and Debriefing System. Development will also begin for update of the AN/MSQ-T4 Modular Threat Emitter to add three additional threat signals.

(4) (U) Program to Completion: This is a continuing program.

C. Major Milestones: Not Applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 6510, Flight Test Simulators

A. Project Description: This project fills a continuing and expanding need to flight test and evaluate new or modified Electronic Warfare equipment to counter systems prior to a production decision. These tests must be conducted in a simulated threat environment including numerous threat radars. In the past, the adaptability of airborne electronic countermeasures systems was quite limited; however, new Radar Warning Receiver

(RWR) signal processing schemes are highly adaptive and make it extremely difficult to construct a test for such equipment without a large number of instrumented threat systems. This project was transferred from PE 64755F, Improved Capability for DT&E, beginning in FY 86, to consolidate development of all threat simulators within PE 64735F.

B. (U) Program Accomplishments and Future Efforts:

(1) FY 1984 Accomplishments: As a part of PE 64755F, FY 1984 funds continued development of the SADS-IV SADS-VIII SARS-VI Generic Radar and WEST-IV systems. The Flycatcher radar began modification to incorporate capability. A Memorandum of Agreement (MOA) was initiated between the Army and Air Force for the Have Copper program. The Office of the Secretary of Defense Executive Committee for Air Defense Threat Simulators (EXCOM) directed tri-service cooperation for procurement of the Have Copper system to reduce development, acquisition, operation and maintenance costs. In the Have Pewter program the contracts for full scale development of the first set of simulators were definitized and a sufficiency requirements review began. Funding was also provided to the EXCOM's CROSSBOW-S committee for tri-Service cooperation in Advanced Threat Simulator design and development efforts.

(2) FY 1985 Program: As a part of PE 64755, FY 1985 funds will continue the ongoing work on the software development, integration and evaluation for SADS-VIII and threat updates to existing simulators; continue development efforts on Have Copper and SARS-VI; complete the evaluation of the Generic Radar; continue full scale development of the first Have Pewter simulators; complete sufficiency requirements review and definization of contract for the first Have Pewter simulator; continue the effort to incorporate capability into the Flycatcher Radar System; begin a new development start on the Airborne Radar Electronic Counter-Countermeasures (ECCM) program; and continue support to the CROSSBOW-S committee.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: FY 1986 funds will continue work on HAVE COPPER, SADS-VIII, SARS-VI, simulator modifications (threat updates), Airborne Radar ECCM and Flycatcher enhancement. The Have Pewter program full scale development effort will continue on the simulators for the first system. Contract definitization will be completed for the second Have Pewter simulators.

(4) (U) Program to Completion: This is a continuing program.

C (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64747F
DOD Mission Area: 454 - Other Test & Evaluation Support

Title: Electromagnetic Radiation (EMR) Test Facilities
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		7,130.	6,911	3,376	3,573	Continuing	N/A
1209	Nuclear Effects Simulation Test Facilities	5,780	5,563	2,049	2,451	Continuing	N/A
2064	HAVE NOTE	1,350	1,348	1,327	1,122	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Nuclear weapon detonations generate electromagnetic pulses which can damage electronic components. Nonnuclear electromagnetic emissions such as jamming may also result in component damage. The equipment malfunctions resulting from these electromagnetic environments may cause a significant reduction in weapon system effectiveness. This program element provides funds to operate and maintain test facilities and analysis capabilities to determine the ability of weapon systems to operate in nuclear (Project 1209) and nonnuclear (Project 2064) electromagnetic environments.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	7,130	7,811	3,450		Continuing	N/A

The FY 1985 reduction was due to Congressional reductions in the requested program. No rationale was provided. Impact of the reduction was a reduction in level of effort on Project 1209. FY 1986 reduction due to inflation adjustments.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Nuclear Effects Simulation Test Facilities, Project 1209, is related to Program Element 64711F, Systems Survivability (Nuclear Effects). Work performed under Program Element 64711F develops weapon system nuclear effects survivability assessment, testing, and hardening techniques, while Project 1209 is directed at implementing a testing capability for one nuclear effect, electromagnetic pulse. The Air Force Weapons Laboratory is responsible for coordinating these efforts. Project 2064 (HAVE NOTE) is the Air Force implementation of the Office of the Under Secretary of Defense Research & Engineering directed Special Electromagnetic Interference Project which directs all three services to test their air-launched weapons and share test results and conclusions. Tri-service reviews are held periodically.

6. (U) WORK PERFORMED BY: Project 1209 is managed by Air Force Systems Command through the Air Force Weapons Laboratory, Kirtland Air Force Base, NM. BDM International, Inc., McLean, VA, is the facilities support contractor. Project 2064 is managed by Air Force Systems Command through the Rome Air Development Center, Griffiss Air Force Base, NY. The test support contractor is Rome Research Corp., New Hartford, NY. Hardness criteria development for acquisition specifications and standards is performed by Electrical Engineering Station, Georgia Institute of Technology, Atlanta, GA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 1209, Nuclear Effects Simulation Test Facilities. This program is for development, acquisition, and baseline support of test facilities which simulate the nuclear electromagnetic environments in which weapon systems may be required to operate. The principal nuclear simulation facilities are the vertically and horizontally polarized electromagnetic pulse (EMP) dipoles and the in-flight electromagnetic pulse simulation facility (TRESTLE). These facilities are used to test aircrsft and missile systems in various operational configurations. Additional capabilities include portable electromagnetic pulse generators for remote site tests and a laboratory used for testing of individual electronic components. Weapon systems program offices arrange for testing time and provide test resources and test costs. The FY 1984 program consisted of completion of EMP evaluations on a Strategic Air Command Communications Command and Control (C^3) effort, a C^3 VAN for the Defense Nuclear Agency (DNA), F/A-18 for NAVY/DNA, TACAMO for NAVY, and special tests for Space Division. Improvements to instrumentation, data acquisition systems, and pulse generators were continued. Upgrade study of the TRESTLE to support E-4B testing was redirected to address the B-1B. The FY 1985 planned program includes electromagnetic pulse testing of the F/A-18, Blackhawk, Patriot and National Aeronautics and Space Administration F-106B for lightning effects. Upgrades of the facilities will continue to meet the defined threat levels to provide testing capability for the B-1B. Other facility improvements which enhance test capabilities will continue. Additional funds for improvements of facilities under Project 1209 are programmed for FY 1984 and 1985, and are reflected in the resource line of this summary. The FY 1986 planned program includes continued upgrades for electromagnetic pulse testing of the B-1B. Facility improvements which enhance other test capabilities will continue. The Air Force and Department of Defense requirement to test weapon system survivability in nuclear electromagnetic environments is continuing. The estimated costs are based on past program experience, adjustments for expected cost growth, and the workload projected to support the above projects. This is a continuing program.

B. (U) Project: 2064, HAVE NOTE. This program is for development, acquisition, and baseline support of test facilities which simulate the nonnuclear electromagnetic environments in which weapon systems may be required to operate. The nonnuclear effort provides facilities for assessing the susceptibility of weapon systems to nonnuclear electromagnetic radiation. This radiation comes from hostile or friendly sources such as radios, radars, jammers, or other electronic devices. These sources can illuminate the weapon for lengthy periods of time, such as when the weapon is enroute to the target. The principal nonnuclear test facility is the Electromagnetic Compatibility Analysis Facility, an anechoic chamber where air launched weapons can be radiated by a variety of signals. The data collected

during testing is also used to update test methods and acquisition specifications, design standards, and maintenance technical orders to ensure that the weapon system is immune to those radio frequency emanations which it may encounter during its life cycle from stockpile to target. Weapon systems program offices arrange the testing time, provide test resources and reimburse for test costs. In FY 1984, testing of the Infrared Maverick and GBU-15 were completed and test reports issued. The new test support contractor was selected. The FY 1985 program includes testing of the Low Level Laser Guided Bomb (LLLGB) and the Advanced Medium Range Air-to-Air Missile (AMRAAM). The FY 1986 program includes continued evaluation of user sponsored systems. Systems currently under consideration include microwave hardware, shielded enclosures, AMRAAM, Maverick retesting, GBU-15 retesting, and continued work on the LLLGB. Simulation improvements which enhance test capabilities will continue. Testing of weapon system survivability in nonnuclear electromagnetic environments is a continuing requirement. The estimated costs are based on past program experience, adjustments for expected cost growth and the workload to support the above projects.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64755F
DOD Mission Area: 451 - Major Ranges and Test Facilities

Title: Improved Capability for DT&E
Budget Activity: 6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		62,700	70,754	46,417	52,964	Continuing	N/A
2870	Aeropropulsion Systems Test Facility (ASTF) Activation	12,635	15,250	0	0	0	47,685
2871	Global Positioning System/ Time-Space Positioning Information (GPS/TSPI)	2,830	6,652	11,110	9,140	2,978	33,110
2873	Integration Facility for Avionic Systems Testing (IFAST)	3,580	2,792	882	980	0	16,012
2874	Integrated Flight Data Processing Systems (IFDAPS)	11,432	6,202	1,371	1,665	0	30,770
2875	Advanced Range Data System (ARDS)	0	149	580	8,430	20,368	29,527
2876	Global Positioning System/ Sonobuoy Missile Impact Location System (GPS/SMILS)	4,016	2,574	3,744	3,133	0	16,917
2880	Advanced Range Instrumentation Aircraft (ARIA) Upgrade	9,403	8,091	9,188	9,150	Continuing	N/A
2960	Calibrated Airborne Spatial Infrared Measurement System (CASIMS)	2,812	0	0	0	0	2,812
6510*	Flight Test Threat Simulators	15,992	29,044	0	0	N/A	N/A
3119**	Airborne Digital Avionics Test System (ADATS)	(296)	(1,425)	2,297	1,317	1,345	4,959
3120**	Seeker Development	(1,538)	(2,400)	2,760	3,601	Continuing	N/A
3121**	Armament Division Computer Sciences	(500)	(1,213)	2,427	2,612	Continuing	N/A
3122**	Armament Division Range Systems Upgrade	(691)	(1,500)	1,168	3,029	Continuing	N/A

Program Element: 64755F
DOD Mission Area: 451 - Major Ranges and Test Facilities

Title: Improved Capability for DT&E
Budget Activity: 6 - Defense-wide Mission Support

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
3123**	Armament Systems Test Environment (ASTE) Range Upgrade	(78)	(400)	348	927	Continuing	N/A
3124**	Air Force Flight Test Instrumentation System (AFFTIS)	(1,842)	(2,944)	2,800	354	956	4,110
3125**	Air Force Flight Test Center Instrumentation Upgrade	(2,053)	(2,338)	5,670	5,470	Continuing	N/A
3126**	Airborne Instrumentation Enhancement	0	(337)	812	783	Continuing	N/A
3127**	Test Pilot School Instrumentation Upgrade	0	0	1,260	415	Continuing	N/A
3131	Airborne Radar Electronic Counter-Countermeasures (ECCM)	0	0	0	1,958	16,615	18,573

* Funding for project 6510 was transferred to PE 64735F, Range Improvement Program, beginning in FY 1986.

** These projects and associated funding were transferred from PE 65807F, Test and Evaluation Support, beginning in FY 1986. Project funding enclosed by parenthesis in FY 1984 and FY 1985 was contained in PE 65807F and is nonadditive in this breakout.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the engineering, development, acquisition and installation of significant new test range and instrumentation systems required for development, test and evaluation. The new systems are required to provide the capability to adequately test and evaluate weapon and support systems currently in development. This Program Element resulted from the need to improve management visibility for major improvement and modernization (I&M) projects at Air Force Research, Development, Test and Evaluation ranges/centers.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	63,500	75,054	72,086	Continuing	N/A

EXPLANATION: FY 1986: Flight Test Threat Simulators (i.e., Project 6510) and associated funding was zero balance transferred to PE 64735F, Range Improvement (subtracts $44,000); nine other ongoing projects (i.e., Projects 3119, 3120, 3121, 3122, 3123, 3124, 3125, 3126, and 3127) and associated funding were zero balance transferred from PE 65807F, Test and Evaluation Support (adds $24,149); inflation adjustment and undistributed reduction (subtracts $5,818).

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The Improvement and Modernization (I&M) program is directly related to the Test and Evaluation Support (PE 65807F) Program since most PE 64755F projects were originally contained within PE 65807F. PE 64755F contains funding for high priority Development Test and Evaluation (DT&E) range support projects. In addition, the improved capabilities benefit all weapon systems test programs which come to the DT&E ranges/centers. In FY 1985, PE 64755F also included funding to develop and field threat simulators. Funding for threat simulators was transferred to PE 64735F, Range Improvement Program, beginning in FY 1986.

6. (U) WORK PERFORMED BY: The I&M programs contained in this Program Element are the responsibility of the applicable range/center commander and his staff. Major contractors performing work on these efforts are identified under the separate project descriptions.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) 2873 - Integration Facilility for Avionics Systems Testing (IFAST): Flight test programs need to evaluate avionics systems performance when operating with weapons systems. Currently, a costly "fly-fix-fly" approach is used. Avionics needs to be ground tested during development and installation with inputs from real missions, as well as from simulated conditions. The Integration Facility for Avionics Systems Testing (IFAST) will provide central computer support for up to four separate avionics test programs. Trouble-shooting is performed during ground testing with real and simulated mission inputs. Portions of avionics systems can be isolated and analyzed with this generic-capability facility as they interact with the entire aircraft weapon system. In FY 1984, the B-1B site preparation was completed and the B-1B program began using two of the four bays. Data processing for the B-52 Air Launched Cruise Missile (ALCM) program began. The Northrop F-20 program occupied one bay. F-16 Multi-National Staged Improvement Program/Low Altitude Navigation and Targeting System for Night (MSIP/LANTIRN) testing was ongoing and concept design review for F-16C/D simulation was completed. Configuration management automation, as well as software development for the central computer, continued. In FY 1985, baseline system design will be completed. Configuration management automation will continue. Software development for the central computer will completed. Initial IFAST development

will be complete by fourth quarter FY 1985. In FY 1986, test program support will continue. F-16C/D full simulation capability will be completed, as well as the performance-monitoring and control system.

B. (U) Project: 2874 - Integrated Flight Data Processing System (IFDAPS): A system is needed to support future test programs at the Air Force Flight Test Center to replace 12 existing flight data processing systems which are not integrated, cannot provide adequate capability for projected future testing, and are becoming unsupportable. The system is needed to provide engineering-unit processing to meet critical real-time and quick-look data needs, with short turnaround time for post-flight data processing. The IFDAPS program provides the hardware, software, and integration necessary for processing, display, control, and storage of flight test mission data. IFDAPS is a mini-computer based system with central data storage. Contractor: Computer Sciences Corporation, Lompoc, CA. In FY 1984, in-plant development continued, software was under development and hardware delivery (Time-Space-Position Information equipment and data reduction systems) to the Air Force Flight Test Center (AFFTC) was accomplished. Training on off-the-shelf equipment was underway. System integration and checkout at the contractor's plant was accomplished and initial capability was completed fourth quarter FY 1984. In-plant development will be completed in mid-85. Software development is an interative process which will continue through FY 1985. Systems training, begun in FY 1984, will continue throughout FY 1985. The Initial Operational Capability (IOC) for the fully integrated system is January 1985. In FY 1986, the Data Base Management System will be operational and a instrumentation calibration station will be installed. System Full Operational Capability (FOC) will be achieved in FY 1987.

C. (U) Project: 2875 - Advanced Range Data System (ARDS): The increasing importance of aircraft and cruise missile operations at low altitude, with multiple test vehicles, requires highly accurate space positioning (sometimes within 15 feet) and continuous communications over increasingly wide areas beyond the present AFFTC range. The Advanced Range Data System (ARDS) program takes advantage of the Global Positioning System (GPS) and other satellite systems to provide the necessary position data and communications. This system replaces numerous ground-based systems with significant savings in manpower and range-support costs. This project started in FY 1985 with initial studies. In FY 1986, concept development will be initiated in conjunction with ongoing GPS Range Applications program, including requirements definition, Program Management Plan (PMP) preparation, and a preproduction capability demonstration.

D. (U) Project: 2876 - Global Positioning System/Sonobuoy Missile Impact Location (GPS/SMILS): Current missile reentry-vehicle scoring sensors require use of deep ocean transponders (DOTs) implanted by ship. Considerable savings and target flexibility are gained when the current Sonobuoy Missile Impact Location System (SMILS) becomes independent of the DOTs. This program develops floating sound sensors (sonobuoys) which determine their position from the Global Positioning System (GPS) and are deployed from the Advanced Range Instrumentation Aircraft (ARIA). Program includes a post-mission data processor and on-board recording, monitoring and processing equipment for the ARIA. A Memorandum of Agreement was signed for the joint 4950 Test Wing/Western Space and Missile Center (WSMC) development of aircraft equipment and instrumentation for SMILS. Contractor: Applied Physics Laboratory/Johns Hopkins University, Laurel, MD. Work was on-going during FY 1984 on the development system. This development system or "system array" includes

Global Positioning System (GPS) capable sonobuoys, the aircraft equipment set, and a post-mission data processor. A demonstration test will occur in early FY 1985 and the competitive procurement package will be started for GPS sonobuoy production. FY 1986: GPS sonobuoy production contract will begin in FY 1986 and the development system hardware will be installed and tested in an EC-18 testbed which will be deployed to various test locations. This inflight testing will take place in conjunction with operational ARIA test support missions.

E. (U) Project: 2880 - Advanced Range Instrumentation Aircraft (ARIA) Upgrade: The ARIA fleet aircraft are required for telemetry processing and command/control functions in support of a multitude of space missions, ICBM launches, cruise missile flights, and aircraft flight test missions. A continuing improvement program is necessary to ensure support of test users requirements, including incorporation of Global Positioning System (GPS) technology. The current improvement program emphasizes conversion of previously purchased C-18 (used Boeing-707/320) aircraft to the ARIA EC-18B configuration and incorporation of a modification for the airborne deployment of the Sonobuoy Missile Impact Location Systems (SMILS). T' effort also includes upgrades of onboard data-processing equipment to meet the increased sensitivity and data rate requirements of the users. The first two C-18s are currently being modified and tested. FY 1984 efforts included procurement and installation of new receivers and instrumentation on the new EC-18 ARIAS and associated level-of-effort type fleet improvements. FY 1985: The rollout and testing of the first EC-18 aircraft will take place during the second quarter of FY 1985. Modifications to the second EC-18 will be completed. In FY 1986, the EC-18 conversion program will continue with aircraft number three being completed, work on number four continuing, and numbers five and six entering modification. A prototype GPS/SMILS system will be installed and tested on an EC-18 ARIA and EC-18 training for ARIA crews will continue.

F. (U) Project: 3119 - Airborne Digital Avionics Test System (ADATS): A generic capability is needed to integrate and flight test software-intensive avionics systems. The Airborne Digital Avionics Test System (ADATS) is a two-phased generic system to provide the 4950 Test Wing with a capability to perform fully instrumented, developmental flight tests of digital avionics. Phase I will be a two-bay ground based simulation laboratory and an airborne test bed. It will give the 4950 Test Wing a basic software-intensive system integration and modification capability. Phase II will add more airborne test beds and increase the computer capability. It will give the wing an independent verification and validation capability, as well as the ability to function at remote test sites. Standardized aircraft and instrumentation interfaces are a goal of ADATS. The system will be built around the MIL-STD-1553 data bus with navigation data, air data and test-item instrumentation included. In FY 1984, as part of the ADATS capability, the 4950 Test Wing operated two working ground-based laboratories and by October 1984, they had two working airborne test beds (pallets). They also worked with various contractors to test the instrumentation interfaces. Procurement of flight hardware began. Longlead items were procured. Mission software was coded and module testing continued. A prototype signal conditioner and interface unit were built and tested. In FY 1985, a competitive procurement for the Phase II effort begins, with contract award early in the fiscal year. ADATS is planned to be used on programs such as B-1B and C-5B during this timeframe. Development of the software testing

capabilities will continue. Development of the Phase II system will continue into FY 1986 and ADATS will support several flight tests for Air Force Wright Aeronautical Laboratories (AFWAL), Wright-Patterson AFB OH, Aeronautical Systems Division (ASD), Wright-Patterson AFB OH, and Electronic Systems Division (ESD), Hanscom AFB MA. Critical design review of the Phase II systems (software testing capability) will be held in early FY 1986, with initial operational capability forecast for third quarter FY 1986.

G. (U) Project: 3120 - Seeker Development: Precision-guided weapons which "home in" on various electromagnetic sources must be evaluated in the presence of natural clutter and obscurants, sophisticated countermeasure scenarios, and threat environments. Ground simulation facilities for seeker development testing need to keep pace with technology demands in infrared, ultraviolet, millimeter-wave, and long wavelength seekers. Laboratory and field instrumentation must be provided to equip test ranges with simulated battlefield targets and conditions. This task will provide: laboratory, field, and airborne instrumentation to support testing of a wide variety of electro-optical seekers in a controlled countermeasure environment; target simulations and an anechoic chamber for ground-laboratory seeker evaluation systems; development of laser radar and millimeter-wave instrumentation; and development of a "real-world scenario" seeker test range. In FY 1984, contracts were awarded for the long wavelength infrared airborne test capability; the weapon survivability test instrumentation, and for the infrared algorithm simulation. Work continued on basic simulation and computer support for ground based seeker test facilities. Initial contracting efforts began on the "real-world" range which is composed of the basic, in-place capabilities plus additional simulation hardware and software. In FY 1985, the long wavelength infrared airborne test capability, weapon survivability test instrumentation, and infrared algorithm simulation will reach initial capability. The contract will be awarded for the high temperature infrared capability at the seeker evaluation facility and airborne long wavelength development will continue. Initial procurement of a ground-to-air infrared evaluation system for seeker vulnerability test will begin second quarter FY 1985. In FY 1986, a high temperature capability will be added to the infrared algorithm test simulator. Expansion of seeker Development Test and Evaluation (DT&E) capability will continue with the Terminally Guided Weapons Test Lab and the scenario range. Major upgrades in seeker vulnerability test capabilities will include countermeasures and obscurant systems.

H. (U) Project: 3121 - Armament Division Computer Sciences: The Directorate of Computer Sciences processes Time-Space-Position-Information, Electronic Combat, Telemetry, and Photo-Optical data in support of the T&E mission. The concept of centralized real-time control and data analysis was formally implemented in 1976. Widespread usage by diverse projects requires that the Centralized Control Facility (CCF) be general purpose, flexible, and expanded. Additional real-time access computers are required in order to eliminate single point failures in a multi-mission test environment and to continue developing a real-time data reduction capability. The Computer Sciences project includes acquisition of several subsystems to improve and modernize real-time computers and displays, and to improve film reading equipment. The expanded capability will support several missions simultaneously, including pre- and post-mission processing. During FY 1984 and 1985, various improvements to the CCF were contained in PE 65807F, Test and Evaluation Support. A military construction project of $0.75 million has been approved for FY 1985 to house computers

and displays for the Centralized Control Facility (CCF). In FY 1986, ten display consoles will be purchased to handle increasingly complex missions and provide real-time support for up to six simultaneous missions. These updates to real-time telemetry support will also support a "dual complex mission" capability and provide efficiently-processed, reliable test data.

I. (U) Project: 3122 - Armament Division, Range Systems Upgrade: Increasing complexity of weapon systems requires faster and more accurate test support equipment, especially basic data collection/processing equipment such as sensors, recorders, and data-relay systems. Increased use of digital data requires that processing equipment be upgraded for faster operation. The smaller aircraft being tested require smaller onboard test support equipment. This project contains two major efforts: airborne instrumentation and multipurpose instrumentation (MPI) upgrades. Airborne instrumentation upgrades include development of smaller transducers, indicators, recorders, and telemetry equipment with capability to process data at higher speeds and with greater accuracy. MPI efforts include communications, timing, command/control, video cameras, microwave, and data-display equipment. Whereas airborne instrumentation equipment is used in aircraft/munitions applications, MPI equipment mostly provides basic ground range capability. In FY 1984, range telemetry equipment and microwave initial procurements commenced. Contract award for microwave upgrades occurred third quarter FY 1984. The range telemetry contract will be awarded in FY 1985 and various airborne instrumentation components will be procured and integrated in existing systems. In FY 1986, considerable effort will continue in range telemetry and microwave systems to provide the real-time "dual complex mission" capability.

J. (U) Project: 3123 - Armament Systems Test Environment (ASTE) Range System: Modernization of data-collection systems is needed to define lethality and safe separation characteristics of ammunition, rocket, and missile munitions. The instrumentation must acquire accurate data for kill mechanism development and for assessment of interaction with various targets and materials. This project will provide the major data collection systems for weapon test missions at Armament Division, Eglin AFB FL. Highly instrumented ground and air-to-ground test areas will be modernized. Upgrade of existing photo-optics equipment, cinetheodolites, and static-arena test instrumentation will be performed. This task also supports all munitions tests on static and active weapon delivery ranges. Initial procurement of the expanded data collection system began in FY 1984 and will continue through FY 1990. In FY 1985, a contract will be awarded for range photo-optics and cinetheodolite systems. Initial capability for new range photo-optics will be reached in FY 1985. In FY 1986, upgrade efforts will continue in the areas of high speed video cameras, photo-optics, and cinetheodolites. Procurement of expanded data collection systems will continue.

K. (U) Project: 3124 - Air Force Flight Test Instrumentation System (AFFTIS): A general purpose flight test instrumentation system is needed to meet future aircraft avionics and structural test requirements at all Air Force Systems Command (AFSC) test centers. It will replace the different systems currently in use at each test center. The design requirements are based on an AFSC-conducted survey of aircraft industry and government agency instrumentation requirements. Air Force Flight Test Instrumentation System (AFFTIS) is an airborne pulse code modulation data acquisition system. The system is modular to allow expansion to meet varied data requirements and provide high data rates,

signal conditioning, data multiplexing, and data formating functions. The Air Force Flight Test Instrumentation System (AFFTIS) consists of a family of approximately ten different types of miniature line replaceable units (LRU) that can be assembled in various combinations to form an airborne instrumentation system. The system design provides an optional airborne processor for display of engineering units to the pilot or crew. Ground support equipment is being developed to fully support preflight and maintenance operations at the aircraft and in the laboratory. Contractor: SCI Systems, Inc., Huntsville, AL, was awarded a cost plus award fee contract in December 1982. The design portion of the program was conducted in FY 1983 and FY 1984. The engineering model development was started in FY 1984 and will continue through FY 1985. A preproduction phase begins in second quarter FY 1985. SCI will supply the three participating test centers (Armament Division, Air Force Flight Test Center, and 4950 Test Wing) a complement of airborne and ground system equipment, as well as training and technical manuals. Preproduction will continue through FY 1986. The first flight test is planned for January 1986 with testing to continue throughout the year. Also continuing will be initial spares provisioning, technical data development, and training activities. The production go-ahead decision will be made in FY 1986.

L. (U) Project: 3125 - Air Force Flight Test Center Instrumentation Upgrade: The range support systems at the Air Force Flight Test Center (AFFTC) are facing saturation. The range instrumentation needs improvements to handle greater data rates, provide increased reliability, and to reduce operation and maintenance costs. Secure telemetry is a goal included in all upgrade plans. AFFTC Instrumentation Upgrade includes: upgrade of the Flight Test Mission Control Center (FTMCC); new and encrypted telemetry receivers; Time, Space, Position Information (TSPI) upgrades, including a star calibration system for existing radars; cinetheodolite improvements; conversion of the Data Acquisition and Transmission System (DATS) form analog to digital; and the addition of a video system to enhance tracking and motion analysis. Most of these upgrades began during FY 1984 in PE 65807F. Originally envisioned as a three to four year effort, the upgrades have been stretched out through 1990 in recognition of available funding. Most of the upgrades began in FY 1984 and will continue into FY 1985 with funding still contained in PE 65807F. Upgrades and equipment purchases will continue in FY 1986. The Military Construction Program (MCP) contains $5.3 million for an addition to the Flight Test Mission Control Center (FTMCC), which will accommodate the Advanced Range Data System (ARDS) ground station and provide more mission control rooms. Generic encryption of existing telemetry systems begins in FY 1986 and a contract will be awarded for a new digital communications switch for the FTMCC. Upgrade of film recorders will be completed, resulting in fewer data reruns and associated lower Operations and Maintenance (O&M) costs. Data links to other ranges such as Tonopah, Nevada will also be completed in FY 1986.

M. (U) Project: 3126 - Airborne Instrumentation Enhancement: Present calibration and printed circuit board (PCB) laboratory equipment used in support of airborne instrumentation is labor intensive and outdated. This upgrade is required to provide state-of-the-art calibration equipment. The Airborne Instrumentation Enhancement efforts will concentrate on obtaining new, smaller sensors with a wider response range, automating the calibration laboratories, and improving the various laboratory systems. This started in FY 1985 with procurement of new sensors spread over a five year period. Acquisition of the new data entry terminals for calibration laboratory upgrade also begins in FY 1985. Sensor procurement, calibration lab, and PCB lab upgrades will continue through FY 1986. Modifications to the

Airborne Test Instrumentation System (ATIS) Test Station and development of the MIL-STD-1553 Databus Facility which begins in FY 1985 will be completed in FY 1986.

N. (U) Project: 3127 - Test Pilot School Instrumentation Upgrade: This is a FY 1986 New Start. More realistic training by use of current aircraft, equipment, and techniques is necessary. Instrumentation is aging and must be upgraded to provide reliable, effective training. Current Test Pilot School aircraft require upgrade of sensors such as accelerometers and gyros. The school will be obtaining new airborne instrumentation such as the new Air Force Flight Test Instrumentation System (AFFTIS--see paragraph K), upgrading the telemetry system, adding a data link to Flight Test Mission Control Center, and adding work stations compatible with the Integrated Flight Data Processing System (IFDAPS--see paragraph B).

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2871 - Global Position System/Time-Space Positioning Information (GPS/TSPI)

A. (U) Project Description: The application of Global Positioning System (GPS) technology for time space and positioning information (TSPI) at the test and training ranges will improve accuracy and coverage, reduce the number of ground-based tracking sites, and enhance inter-range compatibility. This tri-service program implements DOD direction to pursue development of a family of GPS-based range instrumentation equipment. The objective is to miniaturize and configure the GPS receivers and translators to interface with host test and training vehicles and accommodate stringent test range TSPI data requirements. The Range Applications Joint Project Office (RAJPO), Eglin AFB, FL has program management responsibility. Study contractors include SRI, Menlo Park, CA, and TASC, Reading, MA. Demonstration pod contractors include Cubic Corp., San Diego, CA, and Rockwell International (Collins), Cedar Rapids, IA.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The program office prepared contract documentation for a competitive procurement beginning with request for proposal (RFP) release in fourth quarter FY 1984. Develoopment and testing of a demonstration pod was begun in FY 1984.

(2) (U) FY 1985 Program: Contract award for Full-Scale Development is planned for second quarter FY 1985. A demonstration pod will be used to test receivers, antenna, and packaging concepts. The Full-Scale Development Contract will cover FY 1985 through FY 1987 and will develop low and high dynamic receivers and a range system to support the Army's Mobile Automated Field Instrumentation System (MAFIS) and the Air Force Gulf Range Drone Control System (GRDCUS).

(3) (U) FY 1986 Planned Program: The program will be at the height of full-scale development. After several preliminary design reviews in first quarter FY 1986 in support of the Gulf Range Drone Control System (GRDCUS) and the Mobile Automated Field Instrumentation System (MAFIS), a critical design review will be held in mid-FY 1986, with subsequent contract award for delivery of production prototype hardware. If funding becomes available, the Navy Extended Area Training System (EATS), the Navy/Air Force Tactical Air Combat Training System/Air Combat Maneuvering Instrumentation (TACTS/ACMI) and other systems should go on-contract in June 1986. Prototype testing on all major components will be conducted at the Yuma Proving Ground in Arizona.

(4) (U) Program to Completion: Production of prototype range equipment is scheduled through FY 1987. System acceptance testing and Operational Test and Evaluation (OT&E) for each range is planned during FY 1987 and FY 1988. In addition to MAFIS and GRDCUS, other candidate range systems include the Navy EATS, the Navy/Air Force TACTS/ACMI, and the Air Force Advanced Range Data System (ARDS).

C. (U) Major Milestones:

Milestones	Dates
(1) (U) Request for Proposal (RFP) Release	Fourth Quarter FY 1984
(2) (U) Start Full Scale Development	First Quarter FY 1985
(3) (U) Preliminary Design Review (PDR)	Third Quarter FY 1985
(4) (U) Critical Design Review (CDR)	Second Quarter FY 1986
(5) (U) Prototypes Available	Second Quarter FY 1987
(6) (U) System Acceptance Test Begins	Second Quarter FY 1987
(7) (U) Begin Low Rate Initial Production	First Quarter FY 1988
(8) (U) Begin Full Production	Fourth Quarter FY 1988

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65101F
DOD Mission Area: #440 - Technical Integration/Studies and Analyses

Title: Project AIR FORCE
Budget Activity: #6 - Defensewide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		17,876	16,766	17,445	18,295	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This level of effort program funds Project AIR FORCE, the Air Force Studies and Analyses Federal Contract Research Center (FCRC) operated by The Rand Corporation. It provides for continuing cross-functional analytical research across a broad spectrum of issues and concerns to the Air Force in the areas of national security strategy, force employment, technology application and resource management. By design, the Project AIR FORCE research agenda is focused primarily on the mid- to long-term concerns of the Air Force. Results and analytical findings obtained from Project AIR FORCE directly impact senior Air Force management deliberations of major issues facing the Air Force. Additionally, written reports of Project AIR FORCE research findings are widely used throughout the Air Force and the larger defense community.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	16,463	16,766	17,345		Continuing	N/A

(U) A manning level of 150 Members of the Technical Staff (MTS) was approved by OUSDR&E and supported by the Congress in 1976. However, inflation has not permitted this MTS level to be achieved in recent years. Since FY 1981, senior Air Force leaders have indicated their strong support for the program by adding funds, through appropriate reprogramming actions to ensure that critical issues were adequately covered. These additional efforts were within the scope of research best accomplished under Project AIR FORCE and within the 150 MTS level of effort approved in 1976.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Project AIR FORCE studies and analyses are conducted to assist Air Force senior managers in the decision-making process. Consequently, the efforts span functional and organizational boundaries and often result recommendations concerning overall future Air Force actions. Studies conducted impact on strategy and doctrine development, asssessment of operational concepts, innovative uses of advanced technology, and integration of support resources to provide maximum force capability in future warfighting environments. To assure relevance and to prevent unnecessary of effort, each newly proposed research effort is reviewed by a cross-functional group of senior officers and by the Air Force Assistant Chief of Staff for Studies and Analyses. In addition, the results are published and deposited with the Defense Technical Information Center for appropriate dissemination to other qualified recipients.

6. (U) WORK PERFORMED BY: The senior Air Force Group established to review, monitor and approve the research effort, is chaired by the Deputy Chief of Staff for Research, Development and Acquisition, HQ USAF/RD, Washington, DC. The Director of Operational Requirements, DCS/Research, Development and Acquisition, Headquarters USAF, is the Executive Agent and is responsible for the administration of the Project. All work is performed by The Rand Corporation, Santa Monica, CA.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: PE #65101F, Project AIR FORCE

A. (U) Project Description: Project AIR FORCE is a continuing research program. Some 35 to 40 research projects are in various stages of execution during the course of each Fiscal Year (FY). Each individual research project is initiated, processed and approved in accordance with Air Force Regulation 20-9 which requires General Officer sponsorship and involvement on a continuing basis. The research effort encompasses a broad spectrum of aerospace policy and technical issues and is organized into four research programs: National Security Strategies, Force Employment, Technology Applications, and Resource Management.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Research conducted during FY 1984 was keyed to the 20 major issues defined by the Air Force Advisory Group (AFAG) for Project AIR FORCE. Accomplishments based on the Research Plan approved by the AFAG in September 1983 were as follows:

- (U) National Security Strategies: Research focused on concepts of operations for integrated theater warfare, a red-blue analysis of theater nuclear capability, alternative strategies for the Pacific, the role of China and Japan in future East Asia conflicts, Soviet vulnerabilities in Eastern Europe and the impact of internal economics on Soviet power in the 1980s. A major analysis of the policy implications of the Strategic Defense Initiative was completed and the results widely briefed.

- (U) Force Employment: The major effort was to provide a thorough analysis of the viability an utility of tactical air in a Central European conflict to include passive and active defenses, use of unmanned systems, impact of chemical warfare and improved means of air support to the land battle.

- (U) Technology Applications: Space technologies and the contributions of space systems to war-fighting and deterrence were principle concerns. Effectiveness and cost analyses of potential system concepts for Strategic Defense against ballistic missiles were conducted.

Program Element: #65101F
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Budget Activity: #6 - Defensewide Mission Support

- (U) Resource Management: Concentration was placed on the best uses of scarce support resources to maximize warfighting capabilities. Extensive analyses of the tradeoffs between supply, maintenance and transportation policies to maximize the Air Force's ability to generate combat sorties in a dynamic wartime situation were completed. The research program also addressed the design and test needs required to ensure supportability, methodology development for enlisted force management and a means to improve wartime medical support.

(2) (U) FY 1985 Program: In addition to efforts continuing from FY 1984, research will focus on force analysis of modernized long range nuclear forces, potential uses of forces in low-level conflicts, the potential impact of Soviet cruise missiles, improved models of air-land warfare, means to improve integrated situation assessment capability, defense suppression using electronic combat, and ways to enhance airbase survivability. The Warsaw Pact preparations for war and the potential changes in Soviet policy toward Western Europe will be examined. Major emphasis will be placed on the uncertainty in both peacetime and wartime of spares and maintenance requirements and how this uncertainty impacts both the capability and cost of support resources. Space surveillance capabilities, particularly for space defense will be evaluated as well as means of reducing space systems acquisition costs. Appropriate reprograming within the approved MTS level is planned to meet the needs of essential research which cannot be accomplished within the present funding allocation.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The program of research in FY 1986 will evolve from the planned FY 1985 efforts in accordance with the guidance and direction of the Air Force Advisory Group for Project AIR FORCE. The present program structure and emphasis on National Security Strategy, Force Employment, Technology Applications, and Resource Management programs are expected to continue. The interaction of strategic forces, strategic defenses, and arms control measures will likely be a major focus. Demands on conventional forces in European and third world conflicts and adequate support for these forces will continue as a major thrust in the program. Space and space technology, electronic warfare, advanced computing techniques and the analysis of major Air Force policy issues are likely to be the subject of research projects undertaken in FY 1986.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65304F
DOD Mission Area: #360 - Support and Base Communications

Title: Acquisition and Command Support - Telecommunications
Budget Activity: #6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		7,945	7,137	6,550	7,087	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides essential communication services to: Aerospace Medical Division (AMD); Aeronautical Systems Division (ASD); Electronic Systems Division (ESD); Space Division (SD); Ballistic Missile Office (BMO); and the Armament Division (AD). This includes switchboards at ESD and SD; local tielines; equipment rentals; mobile radios for command/disaster control/security police; and official toll calls. This request includes the use of approved inflation rates and additional communications requirements for the Defense Metropolitan Area Telephone System (DMATS) at ESD and the increases in telephone bills and postage rates.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	5,945	7,137	7,614		Continuing	N/A

FY 1984: Funds reprogrammed into this Program Element (PE) to compensate for increase telephone bills primarily for the Boston area DMATS and from commercial rate increases.

FY 1986: Functional transfer of Headquarters, Air Force Systems Command support to the Operations and Maintenance Appropriation.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program element is in direct support of the Acquisition and Command Support account (ACS), PE 65806F.

Program Element: #65304F
DOD Mission Area: #360 - Support and Base Communications

Title: Acquisition and Command Support - Telecommunications
Budget Activity: #6 - Defense-wide Mission Support

6. (U) WORK PERFORMED BY: American Telephone Company, New York, NY; RCA Corporation, New York, NY; Western Union Corporation, Mohwah, NJ; New England Telephone and Telegraph Company, Boston, MA; other communications carriers and communications companies.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 65304F, ACS Telecommunications

A. (U) Project Description: This program continues funding for leased communication lines, switchboards and associated equipment. It also includes: non-tactical radios, and implementation of the Advanced Management and Information System and AFSC network systems.

B. (U) Program Accomplishments and Future Efforts: Not Applicable, continuing support program.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65306F
DOD Mission Area: #440 - Technical Integration/Studies and Analyses

Title: Ranch Hand II Epidemiology Study
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		5,027	3,308	4,695	7,384	46,260	69,057
2767	Ranch Hand II Epidemiology Study	5,027	3,308	4,695	7,384	46,260	69,057

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The study is required to determine long-term health effects of exposure of Air Force (Ranch Hand) personnel and veterans to Herbicide Orange in Vietnam. This program was directed by a 16 September 1980 White House memo from Mr. Eizenstat, Assistant to President Carter for Domestic Affairs and Policy, to Defense Secretary Brown. On 27 March 1981 the Office of Management and Budget confirmed the new administration's desire to continue the study as directed. The Air Force Ranch Hand personnel are the only population whose frequency and duration of exposure to the herbicide are known with any accuracy.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	5,025	3,308	1,494		53,800	69,057

Original predictions for timing of physicals incorrect, rephasing required. Funds rephased in accordance, resulting in significant changes in FY 1986 dollars but no overall change..

4. (U) OTHER APPROPRIATION FUNDS: Not applicable.

5. (U) RELATED ACTIVITIES: This is only one of several federal studies designed to provide information regarding alleged claims of adverse health effects in Vietnam veterans exposed to Herbicide Orange. These studies, include the Air Force study, the Veteran Administration study of twins, and the Centers for Disease Control study of birth defects. These studies are being coordinated by an interagency working group, established by the White House. The working group could require certain changes that would impact funding, scheduling or both.

6. (U) WORK PERFORMED BY: This program is being conducted by the Aerospace Medical Division through the United States Air Force School of Aerospace Medicine, Brooks Air Force Base, TX. Contracts will be awarded for FY 1985 data gathering which will include medical record review, physical examination, and questionnaires.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2767, Ranch Hand II Epidemiology Study. The purpose of this investigation is to determine whether long-term health effects exist in Air Force personnel who served in Vietnam and which can be attributed to occupational exposure to Herbicide Orange. The extensive use of herbicides in Vietnam between 1962 and 1970 was terminated when it became known that a contaminant, tetrachlorodibenzo-P-dioxin (dioxin), was present in the herbicides and that this contaminant caused congenital abnormalities, when administered to pregnant rodents. Subsequent research into the toxicity of dioxin in humans remains equivocal relative to the question of veteran exposure and potential effects. The scientific literature on the toxicity of the components of Herbicide Orange reveals that the two main ingredients have extremely low toxicity, distinctly different from the contaminant dioxin. Past studies have only validated a link between dioxin exposure and subsequent development of acne type skin disease in some non-military exposed groups. Air Force personnel involved with aerial herbicide missions in Vietnam (Ranch Hand) were potentially at greater risk; therefore, an epidemiological investigation of these personnel should identify any adverse effects, if they exist. This 20-year program involves a comparison of Ranch Hand personnel with Air Force crew members/support personnel serving in Vietnam, but who were not exposed to herbicide. Comparisons will be made on mortality rates, present and past health status, and future follow-up health status at the 3-, 5-, 10-, 15- and 20-year periods.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The baseline mortality report was published which reported on the analysis of the data gathered during 1982. The second annual mortality report released in the summer discloses that Ranch Handers are not dying sooner or in greater numbers than their Southeast Asia counterparts taken as an entire group. However, Ranch Hand ground personnel were found to be experiencing higher mortality rates than were comparison ground personnel, with lower rates seen in the Ranch Hand officers. At this time only 3-5% of the study subjects have died, and mortality patterns will become clearer as the study subjects age. For this reason, further annual analyses are intended up to the 20-year point.

(2) (U) FY 1985 Program: This year constitutes the 3-year follow-up phase. An aggressive data collection effort will provide the first look at any change in the health of the 2400 study participants and their offspring. The data collection program consists of gathering and indexing medical records, questioning study participants, physical examination, and laboratory testing. These data will provide the basis for the next several years' analytical efforts on the morbidity of the study population. Concurrently, mortality statistics will be gathered, analyzed and published.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The balance of the 3-year data will be collected during the first quarter. The remainder of the year will be devoted to assimilating the tremendous amount of data gathered into the project data base. This data will be analysed and examined for statistical significance and medical inference. The work will form the basis for the first follow-up morbidity report which will view the changing health status of the Ranch Handers and their offspring and compare those findings with the companion group of non-Ranch Hand flyers.

(4) (U) Program to Completion: This is the fourth year of a 20-year program. Follow-up health status and mortality rate will be determinated at the remaining 5-, 10-, 15- and 20-year time periods. Data analysis, data releases and adaptive changes to the questionnaire or physical examination will occur in the intervening time periods.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65708F
DOD Mission Area: 451 - Major Ranges and Test Facilities

Title: NAV/RADAR/SLED-TRACK Test Support
Budget Activity: 6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		53,939	17,649	28,319	29,689	Continuing	N/A
2900	Radar Target Scatter (RATSCAT) Upgrade	2,000	2,000	2,000	2,000	Continuing	N/A
688G	A/C Navigation System Verification	1,900	1,900	2,000	2,000	Continuing	N/A
3128	Dynamic RCS	0	0	8,000	7,000	0	15,000
06TG	6585th Test Group Support	13,639	13,749	16,319	18,689	Continuing	N/A
3053	RATSCAT Advanced Measurement System (RAMS)	36,400	0	0	0	0	86,000

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The 6585th Test Group and the associated facilities and modernization efforts funded here are part of the Department of Defense (DOD) Major Range and Test Facility Base (MRTFB). The MRTFB is a national asset which is sized, operated, and maintained primarily for DOD test and evaluation missions, but also are available to other users having a valid requirement for its unique capabilities. The unique MRTFB capabilities of the 6585th Test Group include the Central Inertial Guidance Test Facility (CIGTF), the Radar Target Scatter (RATSCAT) facility and the High Speed Test Track. These facilities support a wide range of high priority customer programs which include B1-B, TRIDENT, Peacekeeper, Advanced Medium Range Air-to-Air Missile and various classified programs involving new technology.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	53,704	18,749	19,560		Continuing	N/A

FY 1986: Increase to fund the Dynamic RCS project (adds $8,000); effect of the 1 Jan 1984 civilian pay raise (adds $390); effect of the 1 Jan 1985 civilian pay raise (adds $311); repricing to reflect the effects of a 5% FY 1986 civilian pay cut (subtracts $352); and additional contractor support for RAMS (adds $410).

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands): Not Applicable.

5. (U) RELATED ACTIVITIES: The 6585th Test Group supports testing for a wide range of high priority customer programs such as B1-B, TRIDENT, Peacekeeper, Advanced Medium Range Air-to-Air Missile and various classified programs involving new technology.

6. (U) WORK PERFORMED BY: Overall planning, programming, contracting and associated funding support are provided by the Armament Division (AD), Eglin AFB, FL. The 6585th Test Group manages all program activity and interface with test customers. The primary contractor, Dynalectron of Washington, D.C., operates and maintains the RATSCAT facility. CIGTF, High Speed Sled Track, and the 6586th Test Squadron facilities are operated with government employees and military personnel.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 2900, Radar Target Scatter (RATSCAT) Upgrade. The Radar Target Scatter (RATSCAT) main site facility is an outdoor electromagnetic laboratory which measures radar cross-section (RCS) and antenna patterns on subscale or full scale weapon systems models or on subsystems. RATSCAT main site is unique in its ability to characterize signatures and perform measurements on targets of all sizes. RATSCAT radar cross-section (RCS) measurement is a vital step in the development of new weapon systems. However, RATSCAT main site equipment and facilities are predominantly early 1960's vintage and are in need of repair and modernization. The RATSCAT main site is located on the White Sands Missile Range on a dry lake bed made up of the same gypsum salts which form the adjacent White Sands National Monument. These salts are highly corrosive (when combined with moisture) and have led to progressive deterioration of the RATSCAT buildings and equipment. The upgrade project addresses these facility deterioration and equipment issues through: (1) the time-phased replacement of outdated test equipment; (2) the addition of new technology equipment needed for state-of-the-art RCS testing; and (3) by programming for future Military Construction (MILCON) projects to construct new permanent facilities designed to withstand the corrosive effects of the local gypsum environment. The RATSCAT main site upgrade began with the acquisition of a new "pop-up" calibration facility and two new millimeter wave (MMW) radars. The "pop-up" facility provides a significant enhancement to the accuracy of RCS data collection and will enable the RATSCAT main site facility to keep pace with advancing RCS measurement accuracy requirements. The MMW radars are phase coherent and provide new test capability necessitated by advances in RCS reduction techniques. The RATSCAT main site upgrade continues in FY 1985 with development of the Compact Range, a new indoor test facility for antenna, antenna subsystem, and small vehicle Radar Cross-Section (RCS) characterization.

The Compact Range concept enables the Radar Target Scatter (RATSCAT) main site facility to complement outdoor testing with specific tests wherein the background radar noise is specially controlled and reduced beyond levels achievable outdoors. The Compact Range facility will be completed in early FY 1986. The upgrade effort will continue with the instrumentation of the Lookdown Facility and acquisition of the Integrated Radar Measurement System (IRMS). The Lookdown Facility effort will convert an existing antenna tower into a special test range to measure RCS of targets against cluttered background, providing a simulation of the environment that a "lookdown" airborne threat radar will encounter. The Integrated Radar Measurement System (IRMS) is a major enhancement in main site test efficiency, expanding capability from manually conducted single frequency RCS measurement to simultaneous, multiple frequency testing controlled by a computer. The Lookdown Facility provides a test capability needed by test customers but presently not available. The IRMS will greatly increase the RATSCAT main site facility's test responsiveness and customer workload throughput. A continuing RATSCAT main site upgrade program is planned because of the rapidly changing nature of the technology associated with RCS measurement.

B. (U) Project: 688G - Aircraft Navigation System Verification: Project No. 688G, Aircraft Navigation System Verification, conducts standardized tests and evaluations of inertial and inertially-aided aircraft navigation and weapon delivery avionics systems for DOD weapons systems. Project 688G provides common support for these efforts with a Completely Integrated Reference Instrumentation System (CIRIS) capability. Tasks undertaken by this project include: Inertial Navigation System (INS), Verification Testing, Aided INS Verification Testing, Velocity Sensor Verification Testing, Standard INS Qualification Testing, management and maintenance of the CIRIS, and minor Improvement and Modernization (I&M) of the systems as required to support both the project efforts and users with valid support requirements. In FY 1984 standardized testing of inertial and other navigation systems was accomplished and tests in cargo testbed aircraft in high altitude cruise and low-level penetration flight environments were completed for several High and Medium Accuracy Standard Inertial Navigators. In FY 1985 strapdown ring laser gyro (RLG) inertial systems will be the primary technology evaluated, and upgrades to the CIRIS reference will focus on creation of multiple frequency capability so that CIRIS can simultaneously support multiple test programs without frequency interference. This will involve modification of selected transponders and interrogators to convert them from single to three frequency capability. In FY 1986 the verification and development testing of navigation systems will continue with emphasis on radar and stellar-aided inertial navigation systems. Testing of "high accuracy" RLG technology navigators, commencing now, will continue at a more rapid pace as this technology matures. Upgrades to the CIRIS reference will continue, with incorporation of Global Positioning System update capability and replacement of the current CIRIS inertial measuring unit with a new one based on strapdown RLG technology. Analytical procedures and software will be developed to enable compensation of test data for the effects of gravity anomalies, a process required for evaluation of the higher accuracy INS systems now typically tested. This is a continuing project and the verification and testing of navigation systems will continue into the outyears. Emphasis will continue on aided inertial systems and high accuracy strapdown RLG systems.

C. (U) Project: 3128, Dynamic Radar Cross Section. This is a FY 1986 new start. The project acquires a new, state-of-the-art capability to perform Radar Cross-Section (RCS) measurements on targets in free flight. This data, currently unavailable from government or private industry, is a vital link in bridging the gap between RCS data collected on stationary targets and actual flight environments. This two year effort will acquire a new test site on White Sands Missile Range to collect these data. Planned Initial Operational Capability (IOC) is first quarter FY 1988; thereafter, operation of this facility will be funded in Project 06TG. The new facility will be installed in an existing site on North Obscura Peak, White Sands Missile Range (WSMR). Consequently, no military construction money is required. Funding purchases test radars, other test hardware, computers, and funds associated site integration and activation efforts.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) PROJECT: 06TG - 6585th Test Group Support

A. (U) The 6585th Test Group is a tenant organization at Holloman AFB NM. Holloman AFB is located near Alamogordo NM, adjacent to the White Sands Missile Range (WSMR). This project provides institutional funding for operations, maintenance, improvement, modernization, and personnel in the following three major facilities within the 6585th Test Group. (1) The High Speed Test Track performs rocket sled testing of missile guidance, aircraft ejection systems, and conducts many other types of tests requiring realistic simulations of high acceleration or high velocity environments. The sled-track performed measurements of the PEACEKEEPER guidance system under environmental stress conditions, and recently attained a new world speed record of over Mach 8 while testing rain erosion degradation of reentry vehicles. (2) The Central Inertial Guidance Test Facility (CIGTF) which conducts numerous guidance related test efforts. Typical CIGTF test programs include inertial guidance systems for the PEACEKEEPER and TRIDENT missile systems, ring laser gyroscope development, and gravitational measurements necessary for ballistic missile guidance system testing and development. (3) The Radar Target Scatter (RATSCAT) facilities are used to measure radar cross section (RCS) and antenna patterns on selected sub- and full-scale targets. The new RATSCAT Advanced Measurement System (RAMS), a major advancement in RCS test capability, began operation in the fall of 1984. The 6585th Test Group has full maintenance responsibility for flight test operations of the assigned 6586th Test Squadron. In addition, the 6585th Test Group performs liaison duties for USAF activities on the WSMR, and performs full Federal Aviation Administration (FAA) coordination for all airspace users in the WSMR and Holloman AFB flying areas.

B. (U) Program Accomplishments and Future Efforts:

Program Element: 65708F
DOD Mission Area: 451 - Major Ranges and Test Facilities

Title: NAV/RADAR/SLED-TRACK Test Support
Budget Activity: 6 - Defense-Wide Mission Support

(1) (U) FY 1984 Accomplishments: 6585th Test Group provided services to the Radar Target Scatter (RATSCAT), Central Inertial Guidance Test Facility (CIGTF), and High Speed Sled Track facilities. Funding was used to operate, maintain, and upgrade facilities; conduct and support testing in the areas of inertial navigation systems, high speed sled track simulations, and antenna and radar cross section measurement; support flight test operations of the 6586th Test Squadron; and provide liaison support to the White Sands Missile Range (WSMR). Major programs which were supported include PEACEKEEPER and TRIDENT guidance systems, Crew Escape Systems Technology (CREST), Advanced Guidance Technology (AGT), B-1B Avionics testing, B-1B flight test reference qualification, Navigation Accuracy Instrumentation System (NAIS), USAF directed RCS measurement efforts, and verification of new Inertial Navigation System (INS) systems under Project 688G.

(2) (U) FY 1985 Program: 6585th Test Group funding will continue to support operation, maintenance, and modernization efforts at all facilities; the test and evaluation mission; and liaison with White Sands Missile Range (WSMR). Major programs which will be supported include: verification of new "high accuracy" INS systems under Project 688G; qualification of new INS systems based on "strapdown" ring laser gyroscope technology; rocket sled tests of the T-46A and Advanced Concept Ejection Seat (ACES) II aircrew escape systems; rocket sled tests of the PEACEKEEPER and TRIDENT Guidance Systems; B-1B aircraft Radar Cross-Section (RCS) measurement; flight testing of the Advanced Medium Range Air-to-Air Missile (AMRAAM); Crew Escape Systems Technology (CREST); continuation of the B-1B Avionics effort; and various other USAF directed programs.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Many of the prior year programs continue into FY 1986. These will include RCS tests for numerous USAF directed efforts, testing of the PEACEKEEPER and TRIDENT guidance systems, and rocket sled tests of the T-46A Escape System, CREST and AMRAAM. Other programs scheduled in FY 1986 include rocket sled tests of the B-1B Escape System, the Non-Nuclear Kill (NNK) Warhead, and the Solid Fuel Ramjet. RCS testing for AMRAAM and the new QF-106 full-scale target are also scheduled. Funds requested are the minimum necessary to meet support requirements for programmed efforts in FY 1986.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65806F
DOD Mission Area: #480 - RDT&E Facilities/Management

Title: Acquisition and Command Support
Budget Activity: #6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		321,728	333,269	366,620	426,532	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Acquisition and Command Support (ACS) provides the resources to support the various staff functions, the technical mission, and support activities at each of the six Air Force Systems Command divisions. Categories of cost include civilian pay and the related costs of civilian personnel, travel, transportation, rents, utilities, contractual services, supplies, and equipment. Provides resources for the operation and maintenance of Hanscom AFB, MA; Brooks AFB, TX; Los Angeles AFS, CA; and Ft MacArthur, CA. Approximately 30% of the ACS account finances base operating support costs.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	307,719	354,130	367,063		Continuing	N/A

(U) FY 1984-Increase reflects the impact of the FY 1984 civilian pay raise ($8,010 thousand) as well as a within threshold programmatic reprogramming ($3,999 thousand). FY 1985-Reflects Congressional reduction of $19,920 thousand. FY 1986-Current estimate reflects adds for FY 1984 and FY 1985 civilian pay raises and adjustment for FY 1986 civilian pay reduction.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Military Construction: Funds	8,300	5,450	29,650	14,716	Continuing	N/A

5. (U) RELATED ACTIVITIES: The Air Force Systems Command Management Headquarters is funded in the Operations and Maintenance Appropriation, PE 72898F, Management Headquarters. Communications support for the AFSC divisions is included in PE 65304F - ACS Telecommunications.

6. (U) WORK PERFORMED BY: Major contractors are Delta Patrol Services, Ltd., Los Angeles, CA (security police services for Space Division); Metro Boston Contracting Co., Cambridge, MA (repair and replacement of steamlines at Hanscom AFB); Multi-Service Maintenance, Boston, MA (custodial services for Hanscom AFB); Pacific Services Corp., Pasadena, CA (civil engineering maintenance services for Space Division); and Del-Jen, Inc., Los Angeles, CA (supply and transportation functions for Space Division). There are approximately 255 additional contractors that support one or more of the six listed Air Force Systems Command activities. Total value of these 255 contracts is $34,500 thousand. Aeronautical Systems Division, Wright-Patterson AFB, OH, is responsible for management of aeronautical systems acquisition. Electronic Systems Division, Hanscom AFB, MA, is responsible for command, control, communications and intelligence electronic systems. Aerospace Medical Division, Brooks AFB, TX, provides biomedical support for aerospace systems. Space Division, Los Angeles AFS, CA, plans programs, and manages space systems. Armament Division, Eglin AFB, FL, manages the development, production, and validation of non-ballistic missiles. Ballistic Missile Office, Norton AFB, CA plans, programs, and manages the DOD ballistic missile programs.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 65806F, Acquisition and Command Support

A. (U) Project Description: The ACS account provides the mission support funding for each of the six Air Force Systems Command divisions, the Computer Squadron and Printing Plant at HQ Systems Command, and the Systems Command Management Engineering Teams. This account supports the development and acquisition of such programs as the B-1B and F-16 at Aeronautical Systems Division, Space Shuttle and NAVSTAR Global Positioning System at Space Division, E-3 Airborne Warning and Control System (AWACS) and Over the Horizon Radars at Electronic Systems Division, the Advanced Medium Range Air-to-Air Missile (AMRAAM) and Rapier at Armament Division, the Peackeeper Missile program at the Ballistic Missile Organization, and operation of Brooks Air Force Base which houses the Aerospace Medical Division. Approximately 75 percent of the account finances pay of civilians at these activities.

B. (U) Program Accomplishments and Future Programs:

(1) (U) FY 1984 Accomplishments: Provided support funding for the six AFSC Divisions.

(2) (U) FY 1985 Program: Provides the resources required to effectively manage the development and acquisition of major weapon systems.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Civilian pay is the major cost driver for this account. However, there are specific programmatic changes which drive the costs for FY 1986. At Aeronautical Systems Division (ASD) we see additional support requirements for such programs as the C-17, C-5B, Air Launched Cruise Missile, and Next Generation Trainer as well as an initiative to upgrade classified engineering

computer capabilities at ASD. The FY 1986 program at Electronic Systems Division (ESD) supports funding of the initiative to decrease the Backlog of Maintenance and Repair (BMAR) at Hanscom AFB. At Space Division, a major initiative is planned to upgrade security measures at Los Angeles Air Force Station. At the Ballistic Missile Office, additional funds are required to man and support for the Small Intercontinental Ballistic Missile program.

(4) (U) Program to Completion: Continuing support for development and acquisition of major weapon systems.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65807F   Title: Test and Evaluation Support
DOD Mission Area: 451 - Major Ranges and Test Facilities   Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands):

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		396,947	412,150	431,594	467,920	Continuing	N/A
06RB	Arnold Engineering & Dev Cen (AEDC)	134,871	156,064	173,022	175,645	Continuing	N/A
06ZA	Armament Division (AD)	114,774	107,710	107,368	127,372	Continuing	N/A
06YA	Air Force Flight Test Center (AFFTC)	101,507	104,868	108,713	114,414	Continuing	N/A
06UC	4950th Test Wing (4950 TW)	45,795	43,508	42,491	50,489	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides resources for operating the above Air Force Systems Command (AFSC) test activities which are part of the Department of Defense Major Range and Test Facility Base (MRTFB). Operation of the activities include both technical and base support functions. These activities provide test and evaluation support to the Air Force, other Services, government agencies, and commercial industry. Many capabilities possessed by these test activities do not exist elsewhere.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY ($ in thousands):

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	387,648	437,464	451,971		Continuing	N/A

FY 1984 delta represents: reprogramming action to pay fact-of-life increases (adds $3,999) and FY 1984 civilian pay raise (adds $5,300). FY 1985 delta represents: the FY 1985 Congressional cut (subtracts $24,464) and a pro-rata share of the FY 1985 congressional fuel price adjustment (subtracts $850). FY 1986 delta represents: effects of the 1 January 1984 civilian pay raise on the FY 1986 program (adds $5,566); the FY 1985 civilian pay raise (adds $4,834); fuel repricing and flying hour adjustments (subtracts $1,595); various program adjustments at the Arnold Engineering and Development Center (subtracts $433); Zero Balance Transfer (ZBT) of selected Improvement and Modernization (I&M) programs from PE 65807F to PE 64755F, Improved Capability for DT&E, (subtracts $24,149); repricing to reflect changes in authorized civilian personnel end-strengths and lapse-rates (subtracts $860); repricing to reflect the effects of a 5% FY 1986 civilian pay cut (subtracts $5,092); and added funding for Integrated Logistic Support (ILS) of the Air Force Flight Test Instrumentation System (AFFTIS), base computer system upgrade and Extended Range Anti-armor Munition (ERAM) program support (adds $1,352).

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The test organizations provide test and evaluation support to Air Force programs and those of other Services and Government agencies. Examples include the Air Launched Cruise Missile, F-15, F-16, Peacekeeper, Inertial Upper Stage and Space Transportation System. Additional related activities are covered under each project. Depot Maintenance Industrial Fund (DMIF) fundings to support AFSC test and evaluation aircraft is contained in PE 65863F, RDT&E Aircraft Support. Photo instrumentation and audio-visual activities previously funded in PE 65890F, Audiovisual Activities R&D, were transferred to PE 65807F beginning in FY 1985.

6. (U) WORK PERFORMED BY: Centers of interest are: Arnold Engineering and Development Center (AEDC), Arnold AFS, TN; Armament Division (AD), Eglin AFB, FL; Air Force Flight Test Center (AFFTC), Edwards AFB, CA; and the 4950th Test Wing, Wright-Patterson AFB, OH. Major contractors performing work at each center, shown in parentheses, include: SVERDRUP Technologies, Inc., PAN AM World Services and Calspan Field Services, Inc. (AEDC), RCA Service (AD); and Computer Science Corporation (CSC) (AFFTC).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06RB, Arnold Engineering and Development Center (AEDC)

A. (U) Project Description: AEDC provides ground environment test support for Air Force aeronautical, missile and space programs such as Minuteman, Peacekeeper, F-15, B-1B, Air Launched Cruise Missile, Antisatellite (ASAT) Missile, SRAM II and Advanced Ballistic Reentry Systems, as well as other Service, government agency and industry programs. The center has three facility complexes encompassing wind tunnels, altitude rocket cells, aeroballistic ranges, altitude engine test cells, space chambers and required support and administrative facilities. The test facility complexes are: Von Karman Gas Dynamic Facility which performs aerodynamic testing of scale model aircraft, missile and space systems from Mach 1.5 to 10, testing of large and full-scale satellites, sensors and space vehicles in a simulated space environment and tests of projectiles (both high performance and conventional guns) at various altitudes and reentry conditions; Engine Test Facility which provides altitude environmental testing for aircraft, missile and spacecraft propulsion systems including turbojets, turbofans, and both liquid and solid propellant rockets; and Propulsion Wind Tunnel Facility which provides testing of large-scale models, and in some cases, full scale engine inlet combinations, missiles and space boosters together with their propulsion systems at Mach numbers from 0.5 to 4.5. This National Test Center is used to evaluate aerospace systems, hardware, concepts and prototypes in simulated operational environments. These test complexes are used to assist in obtaining an optimal design, evaluation and certification of performance and acceptance of hardware by providing accurate data at minimum cost. The Center also supports programs of the National Aeronautics and Space Administration, such as Space Shuttle, the Army Ballistic Missile Division and the Navy, as well as technology support to the Department of Energy. The Center's facilities are national assets that provide unique test capabilities not available elsewhere.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Arnold Engineering and Development Center (AEDC) has provided vital environmental test support to most of the national aerospace system development programs such as the F-15, F-16, B-1B, A-10, F100/F110 (formerly the F101 Derivative Fighter Engine (DFE)) Engine Model Derivative Program (EMDP), F-111, Minuteman, Inertial Upper Stage (IUS), Titan Air Launched Cruise Missile (ALCM), SRAM II, Advanced Medium Range Air-to-Air Missile (AMRAAM) and Peacekeeper. Major direct support for environmental testing was provided for advanced surveillance devices, aerospace propulsion and flight dynamics, and munitions development. Support was provided to the Air Force Logistics Command (AFLC), Army, Navy, and National Aeronautics and Space Administration (NASA). The Peacekeeper Stage II Rocket Motor was successfully tested and performance verified at altitude conditions. Completed construction of the Aeropropulsion System Test Facility (ASTF) and activation is proceeding toward an Initial Operational Capability (IOC) in Sep 85. Installed a new rocket motor spin-rig in J-5 cell and successfully spin-tested a large, 91 inch diameter solid propellant rocket motor. Initiated request for proposal for contractual operation of AEDC 1986-1991.

(2) (U) FY 1985 Program: Major direct support for environmental testing is being provided for the AMRAAM, Peacekeeper, Advanced Strategic Missile Systems (ASMS), SRAM II, Antisatellite (ASAT), B-1B and IUS. Support will be provided to the Air Force Flight Dynamics Lab (AFFDL), Air Force Rocket Propulsion Lab (AFRPL) and Armament Division (AD). Support will continue to AFLC, Army, Navy, NASA, and industry. Engine testing will continue to dominate the center's workload which includes: Trident II missile motor, J85, F109 (KC-135R Reengine) and Japan XF-3 Engine tests, and small missile. Several FY 1984 programs will be continued such as the F100 and F101 Component Improvement Program and F110 Derivative Fighter Engine development. In order to provide the best possible test data at minimum cost AEDC will continue developing technology and instrumentation to improve and modernize its existing ground test capabilities. Inflation to contracts, contractor personnel benefits, and utilities will cause increases in funding over FY 1984 levels. The three AEDC operating contracts will be competed and awarded for a five year period.

(3) (U) FY 1986 Planned Progam and Basis for FY 1986 RDT&E Request: The center will continue to be a prime contributor to the successful development of DOD and National Aeronautics and Space Administration (NASA) aeronautical, missile and space systems such as Advanced Strategic Missile Systems ballistic re-entry systems, Wide Area Antiarmor Munition, Space Shuttle, Peacekeeper, F-16, Next Generation Trainer (T-46A), and aircraft stores separation testing. Aerodynamic testing programs will also be conducted for the Foreign Technology Division. Additionally, Arnold Engineering and Development Center (AEDC) will provide support for other customers, such as the Navy, Army, and commercial industry. Funds requested for FY 1986 will allow AEDC to meet the above objectives by providing the institutional portion of the center's operating expenses needed to support user requirements. These funds provide for the operation and maintenance needs of this RDT&E activity. Included in these operating expenses are civilian pay, travel, transportation, rents, communications, utilities, contractual services, supplies and equipment and upkeep of existing facilities to provide safe, competent and credible testing.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06ZA, Armament Division (AD)

A. (U) Project Description: AD is the host organization at Eglin AFB, FL, and is the prime USAF organization charged with nonnuclear armament development. Eglin AFB, located in northwest Florida, is the largest Air Force Base in the free world, encompassing 724 miles of land and 86,500 square miles of water test ranges extending almost 240 miles south into the Gulf of Mexico. AD accomplishes technology research, engineering development, test, evaluation ation, and initial acquisition of USAF nonnuclear munitions. AD is the USAF focal point for munitions integration in aeronautical systems; conducts and supports USAF weapons effectiveness testing, electronic combat (EC) testing, electronics surveillance and control testing, and aeronautical systems testing. AD conducts more than 500 test projects per year, such as the Advanced Medium Range Air-to-Air Missile (AMRAAM) and the French Durandal runway cratering munition; conducts environmental testing of entire aircraft in the McKinley Climatic Laboratory; and manages the Sensor Fused Weapon test program. To accomplish its mission, AD utilizes over 50 instrumented test areas, sites, and ranges, and operates 43 aircraft of eight different types. The ranges are divided into four general categories: Armament Systems Test Environment (ASTE), Electromagnetic Test Environment (EMTE), Multipurpose Resources (MPRs), and the Water Test Areas (WTAs). The aircraft types used include F-4, F-15, F-16, F-111, A-10, T-38, T-39, and UH-1N. The test and evaluation effort and base operational support requirements are funded under this Program Element. The Acquisition and AD Staffs are funded under Program Element 65806F, Acquisition and Command Support.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Armament Division funding was used for the following purposes: to operate, maintain, and upgrade the highly instrumented gulf test range complex at Eglin AFB; conduct and support testing in the areas of nonnuclear munitions, electronic combat, and missiles and munitions/aeronautical system intigration; support USAF, OSD, and other government agencies in test programs; provide administrative, logistical and technical support to approximately 10,000 assigned tenant personnel. Major programs which were supported include: Advanced Medium Range Air-to-Air Missile (AMRAAM), Precision Location Strike System (PLSS), Joint Tactical Information Display System (JTIDS), Sensor Fused Weapon (SFW), Seeker Evaluation and Test System (SETS), and PAVE MOVER.

(2) (U) FY 1985 Program: Armament Division funding will continue to support critical test and evaluation efforts for developing nonnuclear munitions and electronic combat systems. AMRAAM test and evaluation will continue in FY 1985, as will acquisition and testing of the Gulf Range Drone Control Upgrade System (GRDCUS). The GRDCUS is a

vital new Global Positioning System (GPS) based range instrumentation system needed for AMRAAM and other advanced missile tests. Testing associated with the Generic Radar and SEEK EAGLE munitions certification on the F-15 and F-16 will also continue. Additional test programs scheduled for FY 1985 include the Airborne Self Protection Jammer (ASPJ), the Joint Tactical Information Display System (JTIDS), and the Precision Location Strike System (PLSS), testing of the Firebolt Supersonic drone, testing of the ALR-38 avionics system upgrade for the F-4G and tests of the tactical electronic warfare system for the F-15. FY 1985 funds will also provide for operation, maintenance, and modernization efforts at the Eglin test range complex and for support of tenant organizations.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Armament Division, which currently has over 500 test projects in being, expects to support nearly 600 programs in the FY 1986 timeframe. Funds requested for FY 1986 represent the minimum necessary for adequate support of firm development test and evaluation commitments for air munitions and electronic combat systems needed by the using commands. In addition to continuing F-15 and F-16 munitions certification projects (SEEK EAGLE), AMRAAM, GRDCUS, Generic Radar, JTIDS, and PLSS, Armament Division will start additional major test programs in FY 1986 to include the Joint Surveillance Target Attack Radar Systems (Joint STARS) and the Advanced Short Range Air-to-Air Missile (ASRAMM). Funds for FY 1986 will continue to cover operation, maintenance and modernization of the RDT&E test facilities. Included in these operating expenses are civilian pay, travel, transportation, rents, communications, utilities, contractor services, supplies, equipment, and facilities upkeep.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

10. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06YA, Air Force Flight Test Center (AFFTC)

A. (U) Project Description: The AFFTC conducts and supports tests of aircraft and aircraft systems, aerospace research vehicles, remotely piloted vehicles, cruise missiles and parachute delivery/recovery systems. Major weapon systems undergoing testing at Edwards AFB, CA include the F-16 and F-15 Multi-Stage Improvement Programs (MSIPs), F-20, Antisatellite (ASAT), Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN), HH-60, B-1B and Air Launched Cruise Missile (ALCM). The 6514th Test Squadron at Hill AFB, UT, conducts tests of remotely piloted vehicle systems and the Ground Launched Cruise Missiles using the Utah Test and Training Range to evaluate research, tactical and reconnaissance drone systems for military applications. Air Force parachute testing is the responsibility of the 6510th Test Wing. The AFFTC also operates the United States Air Force Test Pilot School which annually trains 50 Department of Defense, allied and contractor test pilots, flight test navigators, and flight test engineers. Recovery support and engineering evaluation is also provided to the space shuttle program for landing at Edwards AFB.

The Air Force Flight Test Center (AFFTC) also operates the Edwards Flight Test Range. AFFTC support for the Northrop F-20 program is fully reimbursed by the contractor.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Testing continued on the A-10, F-15, F-16, B-1B, B-52, and derivative fighter programs. The F-16 Advanced Fighter Technology Integration Program started and will continue into FY 1985. The KC-135 Reengine program flight testing was completed and the F-20 program testing continued. Ground Launched Cruise Missile testing was ongoing. The B-52 improvements and ALCM testing continued. Various technology base programs were tested including such programs as the F-15 Integrated Flight Fire Control System. Space Shuttle operations were conducted by National Aeronautics and Space Administration (NASA) with Air Force participation. Testing of the B-1B, and Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) programs were ongoing.

(2) (U) FY 1985 Program: FY 1985 is a continuation of a surge period in flight testing at AFFTC which began in FY 1984. Numerous high priority flight test programs with extensive and diverse test support requirements will be in active testing in 1985. Major programs will include continuation of B-1B and LANTIRN, along with various programs for the F-15, F-16, F-15E, and F-20. The ASAT program started testing in FY 1984 and will remain active in 1985. Cruise missile flight testing will be heavy and Edwards will also serve as both prime and back-up landing site for several Space Shuttle missions. The HH-60 and the F-16 Multi-Stage Improvement Program will also be engaged in extremely active testing and testing of the X-29 Forward Swept Wing Fighter begins.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Funding requested for FY 1986 is a necessary prerequisite to timely completion of major flight test efforts crucial to the development of numerous new aircraft weapons systems. Air Force Flight Test Center (AFFTC) has a firm customer forecast for the year which shows continuation of the surge in testing begun in FY 1984. The B-1B, cruise missile, F-16, F-15, F-15E, Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN), T-46A, HH-60, X-29A, Antisatellite (ASAT), and F-20 flight test programs will all continue with an increased pace of activity. Space Shuttle missions will continue to require extensive support from Edwards throughout FY 1986. In the aggregate, these test program requirements represent a substantial increase in AFFTC support activity which cannot be deferred without jeopardizing weapon system deployment schedules. Funds requested provide for operations and maintenance of AFFTC to support these requirements, and include civilian pay, travel, transportation, rents, communications, utilities, contractor services, supplies, equipment, and facilities upkeep.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

11. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 06UC - 4950th Test Wing (4950 TW)

A. (U) Project Description: The 4950th Test Wing, Aeronautical Systems Division, Wright-Patterson AFB, OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for the Air Force Systems Command's (AFSC) Space Division, other DOD agencies, and the National Aeronautics and Space Administration. The Wing operates AFSC's major Class II aircraft modification facility. Flight tests have varied from evaluations of an airborne side-firing cannon to investigation of state-of-the-art airborne laser systems and night attack sensors. The Wing has the capability to conduct full-scale engineering evaluations, airborne instrumentation and data reduction, Class II aircraft modification and extensive technical photo documentation. Staging out of 13 overseas bases, the Advanced Range Instrumentation Aircraft (ARIA) fleet of seven aircraft provide telemetry support for the National Aeronautics and Space Administration (NASA) and DOD missile launches out of Cape Canaveral, FL, and Vandenberg AFB, CA. The Deputy Commander for Aircraft Modification accomplishes mechanical and electronic modifications to AFSC test aircraft to support flight test programs. Fabrication support is also provided to the Air Force Wright Aeronautical Laboratories. The Wing is the functional manager for Class II Aircraft Modification policy throughout AFSC.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Flight test accomplishments included Airborne Laser Laboratory, Little/Big Crow (joint T-39/C-135 test bed aircraft modified to support the Army Patriot Program by providing electronic jamming capability), Sabre Cross II electronic countermeasures system, NAVSTAR Global Positioning System (GPS) Phase II, Detection of Laser RADAR, and Millimeter (DOLE RAM) threat warning system, Mark XII Identification Friend or Foe (IFF), Central Inertial Guidance Test Facility (CIGTF) support, Tactical Bistatic Radar Demonstration (T-BIRD), and Dual Mode missile warning system. The flight test program supporting the Airborne Laser Laboratory was completed in FY 1984. ARIA support of DOD and National Aeronautics and Space Administration (NASA) missile/space vehicle launch telemetry and Air Launched Cruise Missile Programs continued. Work continued on incorporating Computer Aided Manufacturing (CAM) equipment into the Class II aircraft modification facilities.

(2) (U) FY 1985 Program: Flight test programs to be supported include B-1B, Tail Warning System, Microwave Landing System, C-5B Test Program, Sabre Cross II and Dual Mode missile warning system, Joint Surveillance and Target Attack Radar System (Joint STARS), Little/Big Crow, and Central Inertial Guidance Test Facility (CIGTF). Advanced Range Instrumentation Aircraft (ARIA) will provide telemetry support to DOD/NASA missile and space vehicles to include TRIDENT, Peacekeeper, Inertial Upper Stage, Pershing, TITAN 3D, Poseidon, Defense Meteorological Satellite Program (DMSP), Space Defense System, and Cruise Missile. Work will continue on the Wing's Computer Aided Manufacturing (CAM) modernization program. Wing operation/maintenance crews will continue proficiency training on the C-18A program and gather baseline performance test data on the basic aircraft. Increased C-18A training flights will exercise the

logistics supportability of the aircraft systems in preparation for the first EC-18B Advanced Range Instrumentation Aircraft (ARIA) operational telemetry support missions in the spring of 1985. Extensive aircraft modification will continue on the EC-18B/ARIA conversion project, with two aircraft in the modification process. Emphasis will continue on special procedures used for certain small test programs which expedites the Class II aircraft modifications process for those programs.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Maintain efforts on continuing flight test and ARIA support of DOD and National Aeronautics and Space Administration (NASA) programs. Continue support for specified, future DOD flight test program such as Mark XV Identification Friend or Foe (IFF), Advanced Tactical Radar, and Joint Surveillance and Target Attack Radar System (Joint STARS). The in-house integrated Computer Aided Design/ Computer Aided Manufacture (CAD/CAM) system will be used to conduct engineering design and fabrication for Class II aircraft modifications. A significant number of Class II aircraft modification projects will be contracted out for engineering design, manufacturing, and installation due to shortage of in-house capability. The second EC/18B/ ARIA will be flight tested and enter operational service. Two other EC-18B/ARIA conversions will be in progress. The ARIA fleet will eventually consist of six EC-18B and two EC-135E (JT-3D reengined EC-135N model ARIAs). The Sonabouy - Missile Impact Location System (SMILS) will be installed in a prototype configuration on a C-18A and flight tested before this aircraft enters the ARIA conversion effort. The SMILS mission will be an additional task performed by the ARIA fleet which complements the traditional telemetry relay and recording functions.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65808F Title: Advanced Systems Engineering/Planning
DOD Mission Area: #440 - Technical Integration/Studies & Analyses Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,663	2,500	3,895	4,344	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force has the inherent need to conduct development planning (mission area planning, systems architecture, and systems acquisition planning) to convert operational requirements into effective weapon systems. This program provides technical support for the development planning function at the Electronic Systems Division (ESD) and Space Division (SD). This includes the definition of systems architectures required to meet national objectives, acquisition planning for future systems, and the identification of technology need to satisfy these future operational requirements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,363	3,631	3,981		Continuing	N/A

- In FY 1985, Congress cut $1.131 million.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The space architecture planning and the command, control, communications and intelligence (C^3I) architecture planning activities supported by this program element provide the advanced development planner with the guidance needed to perform cost effective acquisition of advanced C^3 systems. The technology needs identified provide guidance to the development planners and their associated program elements, such as C^3 Advanced Development (PE 63789F), Advanced Spacecraft Technology (PE 63401F), and Missile Surveillance Technology (PE 63424F).

6. (U) WORK PERFORMED BY: The primary technical support for this program is provided by the Aerospace Corporation, El Segundo, CA, and the MITRE Corporation, Bedford, MA.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 65808F, Advanced Systems Engineering/Planning

A. (U) Project Description: This program provides technical support for the development planning function at ESD and SD. The effort includes the identification of new concepts and technology for future systems; architectural

planning for future strategic and tactical systems; identification of advanced capabilities concepts; preparation of technology development guidance to support these concepts; and the initial program planning for systems acquisition programs required to satisfy operational needs.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Electronic Systems Division (ESD) continued to support planning for the orderly transition from current command, control, communications (C^3) systems to future systems which provide increased capability, particularly the future Tactical Air Control System (TACS). Technology guidance planning continued. Space Division (SD) updated the Architecture for Military Space Systems. SD also supported the development of space standards, and concept development for a space-based system for defense against ballistic missiles.

(2) (U) FY 1985 Program: ESD will continue to perform analyses in support of tactical command, control, communications and intelligence (C^3I) requirements. SD will perform analyses relating to the future space force structure, such as mission analyses for a military aerospace vehicle and space support for the relocatable target problem. Both portions of the program will continue to provide technology planning guidance for development programs.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 86 program will continue to support system acquisition development planning functions, primarily at ESD and SD. The overall objective is the conversion of operational requirements into effective military capability. In FY 86 this will include mission area planning to broadly examine Air Force capabilities, potential deficiencies, and established development goals; a system architecture to provide a time phased plan for meeting those development goals; and top level planning to define control system characteristics for a future missile system at SD with the supporting C^3 planning being developed at ESD.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65863F
DOD Mission Area: 454 - Other Test and Evaluation Support

Title: RDT&E Aircraft Support
Budget Activity: 6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984* Actual	FY 1985* Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		(40,024)	47,511	59,820	64,943	Continuing	N/A
2111	Armament Division	(11,299)	9,056	8,318	9,654	Continuing	N/A
2112	Air Force Flight Test Center	(8,679)	24,306	30,128	30,224	Continuing	N/A
2114	4950th Test Wing	(20,046)	14,149	21,374	25,065	Continuing	N/A

*This was a new Air Force program element beginning in FY 1985. Prior to FY 1985, funding for this Test and Evaluation aircraft support requirement resided in over 60 RDT&E support and weapon systems test programs. In FY 1985, funding was consolidated within PE 65863F to enhance management visibility and program stability, and to make the program consistent with similar Air Force, as well as Army and Navy, aircraft support programs. Funding enclosed by parenthesis in FY 1984 resided in other program elements and is shown here for information purposes only.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Test and Evaluation Aircraft Support Depot Maintenance Industrial Fund (DMIF) program provides resources for maintaining all Air Force Systems Command (AFSC) assigned test and test support coded aircraft which are included as a portion of the Department of Defense Major Range and Test Facility Base (MRTFB). Funds are used to pay for depot level type maintenance such as: Programmed Depot Maintenance (PDM), which is the calendar-based cyclic scheduling of aircraft into the depots for update/inspection; modifications and Time Compliance Technical Orders (TCTOs); engine overhauls; exchangeables (recoverable components, such as fuel pumps and electric motors, returned to the depots for repairs); and depot provided area assistance. This program currently supports 195 RDT&E aircraft of 24 different types. Many of these aircraft are unique (pre-production, one-of-a-kind, etc.), and the majority are highly modified and/or uniquely instrumented. The wide variety and small quantity of each type aircraft possessed, the unique/highly modified condition of the test aircraft, the often dedicated status, and the individual work packages (when compounded by the demanding nature of the test environment) result in many challenging management problems which are routinely solved to assure that this large fleet of test aircraft is efficiently and effectively maintained.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	(40,024)	47,511	49,680		Continuing	N/A

FY 1986: The FY 1986 funding estimate as listed in the FY 1986 column of the FY 1985 Descriptive Summary portrayed a FY 1986 program funding level which was $10,140 less than actual program requirements. This shortfall was due to late definition of several new program requirements (such as the F-15 wing foam change), customer charge increases for the Depot Maintenance Industrial Fund (DMIF) and the inability to adequately identify all of the Major Range and Test Facility aircraft flying hour customer programs as sources for the original zero balance funding transfer. The increased FY 1986 funding estimate listed in this FY 1986 Descriptive Summary now reflects a repriced and fully funded program which was attained by completing the FY 1986 and outyear zero balance transfer of all required DMIF funding into this RDT&E Aircraft Support program element. This final zero balance transfer of DMIF funding adds $10,140 in FY 1986.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The aircraft supported by this program element are either the primary test vehicle or provide test support for Air Force Systems Command (AFSC) research, development, test and evaluation projects.

6. (U) WORK PERFORMED BY: Depot level maintenance is performed either organically (by the Air Force Logistics Command (AFLC) Air Logistics Centers (ALCs)) or contractually (with the ALCs negotiating/administering the contract). Organically, work is performed at all five AFLC ALCs: Ogden ALC, Hill AFB, UT; Oklahoma City ALC, Tinker AFB, OK; San Antonio ALC, Kelly AFB, TX; Sacramento ALC, McClellan AFB, CA; and Warner Robins ALC, Robins AFB, GA. Contractually, work is being performed by McDonnell Douglas Corp., Tulsa, OK; Boeing Military Airplane Company, Wichita, KS; Lockheed Corp., Marietta, GA; Hayes International Corp., Birmingham, AL; and Vought Corp., Dallas, TX. Other contracts may be forthcoming, but this is normally dependent upon the projected workloads within each AFLC Air Logistics Center.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 2111, Armament Division (AD). The Armament Division, Eglin AFB, FL, is the prime USAF organization responsible for nonnuclear munitions armament development. AD accomplishes technology research, engineering development, test and evaluation and initial acquisition of USAF nonnuclear munitions, is the USAF focal point for munitions integration in aeronautical systems, conducts and supports USAF weapons effectiveness testing, electromagnetic warfare testing, electronic surveillance and control testing, and aeronautical systems testing. AD currently has the following types and quantities of test/test support aircraft assigned: A-10A(2); F-4C(3); F-4D(5); F-4E(2); F-15A(6); F-15B(2); F-15D(1); F-16A(10); F-111E(2); H-1N(2); T-38A(6); and T-39A(1). Total aircraft assigned: 43. In FY 1984 programmed Depot Maintenance (PDM) was accomplished on three F-4s and two F-111s. One F-15 was input for wing foam change and Time Compliance Technical Order (TCTO) update. Three F-16s went through the FALCON RALLY II electrical system enhancement program. Based upon time change requirements, 34 engines and support equipment items were input for overhaul. Armament Division (AD) flew 6,074.2 hours for this fiscal year. In FY 1985 three F-4s and one F-111 will be

due PDM. Three F-15s will be input for wing foam change and TCTO update; and three F-16s will be input to the FALCON RALLY II electrical system enhancement program; two A-10s will have the gun-gas mod accomplished; seven F-16s will have FALCON SWEEP aircraft systems modification updates accomplished; two H-1s will have a condition inspection accomplished; the T-38s will receive an engine mod; one F-15 will be input for spar recycle, vertical stabilizer repair and wing riser runout. AD has projected 5,192 flying hours which will generate corresponding engine overhaul and exchangeable requirements. In FY 1986 PDM will be accomplished on three F-4s; wing foam change and TCTOs will be done on one F-15; spar recycle, vertical stabilizer repair and wing riser runout will be done on five F-15s; FALCON RALLY II will be done on one F-16; an in-depth inspection will be done on one UH-1N and a minor inspection of the other UH-1N; TCTOs will be done on two F-111s and two A-10s. Eglin has projected 4,640 flying hours which will generate corresponding engine overhaul and exchangeable requirements. This is a continuing program. Continuing support will be required for assigned aircraft. Yearly costs will fluctuate depending upon flying hours, the number of aircraft due PDM, and the types and numbers of modifications being accomplished.

8. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2112, Air Force Flight Test Center (AFFTC)

A. Project Description: The AFFTC, Edwards AFB, CA, conducts and supports tests of aircraft and aircraft systems, aerospace research vehicles, remotely piloted vehicles, cruise missiles and parachute delivery/recovery systems. Support for the AFFTC aircraft located at the 6514th Test Sq at Hill AFB, UT is also funded within project 2112. The 6514th Test Sq performs tests on remotely piloted vehicle systems and the Ground Launched Cruise Missile. The AFFTC currently has the following types and quantity of test/test support aircraft assigned: A-7D(9), A-10A(2), A-37B(3), B-1(2), B-52G(1), B-52H(1), C-130H(3), F-4C(5), RF-4C(5), F-4D(3), F-4E(10), F-15A(4), F-15B(1), F-15C(1), F-15D(1), F-16A(7), F-16B(3), F-16C(3), F-16D(1), F-111A(1); F-111D(3); F-111E(1), H-1H(2), H-3E(3), H-53C(2), HH-60A(1), O-2A(5), T-38A(23), and U-6(1). Total aircraft assigned: 107.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Programmed Depot Maintenance (PDM) was accomplished on five F-4s and on one F-111D. Mid-life Inspection was done on three A-7Ds; Time Compliance Technical Orders (TCTOs) were done on A-10s, F-111s, H-1s, and T-38s. Based upon time change requirements, 64 engines and support equipment items were input for overhaul. Air Force Flight Test Center (AFFTC) flew 22,963 hours in FY 1984.

(2) (U) FY 1985 Program: PDM will become due on one C-130H and four F-4 aircraft. Three A-7Ds are scheduled for Mid-Life Inspection. One C-130 is scheduled to receive redesigned outer wings. Five F-15 aircraft will be input for wing foam change and TCTO update; the FALCON RALLY II electrical system enhancement program will be accomp-

lished on three F-16s; TCTOs will be done on A-10s, F-4s, a HC-130H, F-16s (FALCON SWEEP), H-1s, H-3s, and T-38s. AFFTC is projecting 22,692 flying hours, which will generate corresponding engine overhaul and exchangeable requirements.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Mid-Life Inspection will be done on one A-7. PDM will be done on one C-130H, and seven F-4s; Analytical Condition Inspection (ACI) will be done on one H-53 and one H-1. TCTOs will be done on nine A-7s, two A-10s, four RF-4Cs, eight F-15s, and three H-3s. FALCON RALLY II will be accomplished on four F-16s. Wing foam change/TCTOs are scheduled on one F-15D. Special repairs will be done on the bulkhead area on the F-16s, and on the spar/vertical stabilizer, and wing risers on the F-15s. Air Force Flight Test Center (AFFTC) is projecting 21,762 flying hours, which will generate corresponding engine overhaul and exchangeable requirements.

(4) (U) Program to Completion: This a continuing program. Continuing support will be required for assigned aircraft. Yearly costs will fluctuate depending upon flying hours, the number of aircraft due Programmed Depot Maintenance (PDM), and the types and numbers of modification being accomplished.

C. (U) Major Milestones: Not Applicable.

9. (U) PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2114, 4950th Test Wing (4950TESTW)

A. (U) Project Description: The 4950th Test Wing, Aeronautical Systems Division, Wright-Patterson AFB, OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for the Space Division and other DOD and National Aeronautics and Space Administration organizations. The 4950th Test Wing currently has the following types and quantity of test support coded aircraft assigned: C-18A(8); C-130A(4); C-135A(10); C-135E(6); C-135N(2); C-141A(4); T-37B(1); T-39A(1); and T-39B(6). Total aircraft assigned: 42. Aeronautical Systems Division, Wright-Patterson AFB, OH, is responsible for aircraft leased to contractors, loaned to other Government agencies, or furnished to contractors under Government Furnished Property (GFP) clauses. Depending on the reason for the loan/GFP, Air Force System Command (AFSC) can incur liability for the depot level maintenance (DLM) for these aircraft. The 4950th Test Wing account is the medium through which the Air Force programs and pays for support of these aircraft. Based on current and projected FY 1985/86 contracts and agreements, AFSC is responsible for DLM costs associated with one NC-131H, one NF-111A, and one NT-33A.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: PDM was accomplished on two C-135s and one C-141. Analytical Condition Inspection and corrosion treatment was done on one T-39. Wing reskin mod was accomplished on one C-135; Time Compliance Technical Orders (TCTOs)/mods were accomplished on C-130s, C-135s, and C-141s and the GFP NF-111A. Eight engines and support equipment items were overhauled. 4950th Test Wing flew 7,290 hours for this fiscal year.

(2) (U) FY 1985 Program: In FY 1985, the following aircraft will be due PDM: two C-18s, two C-135As, one C-135E, one C-135N, and one C-141A. Two C-135As and one C-135E will receive the wing reskin modification. Three T-39s are scheduled for analytical condition inspection (ACI) and life extension modification (LEM). Time Compliance Technical Orders (TCTOs) are programmed for the C-130s, C-135s, C-141s, NF-111A and the T-39s. The 4950 Test Wing anticipates flying 8,226 hours, which will generate corresponding engine overhaul and exchangeables requirements.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: PDM will be accomplished on two C-18s, two C-130As, seven C-135s, and one C-141. Analytical Condition Inspection and Life Extension Modification will be done on three T-39s. Mods/TCTOs will be done on C-130s, C-135s, C-141s, the GFP NF-111A and the GFP NT-33A. The 4950th Test Wing anticipates flying 8,933, hours which will generate corresponding engine overhaul and exchangeable requirements.

(4) (U) Program to Completion: This is a continuing program. Continuing support will be required for assigned aircraft. Yearly costs will fluctuate depending upon flying hours, the number of aircraft due Programmed Depot Maintenance, and the types and numbers of modifications being accomplished.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65872F
DOD Mission Area: 490 - Production Base Support

Title: Productivity Investments
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		1,980	3,000	7,009	8,556*	Continuing	N/A
2958	Productivity Investment Fund (PIF)	1,980	1,661	7,009	8,556*	Continuing	N/A
3008	Publication Information Processing and Printing System (PIPPS)	0	1,339	0	0	0	1,339

* Funding shown only for currently approved subprojects. Funding decisions for additional subprojects in each year are made by the Office of the Secretary of Defense (OSD) in preparation of the President's Budget for that year.

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Productivity Investment Fund (PIF) project is part of a continuing OSD-wide program to provide funds for the purchase or lease of productivity enhancing equipment and facilities. Subprojects for USAF activities funded by the RDT&E appropriation are funded in this program element. Candidate subprojects are submitted to HQ USAF for extensive review and validation prior to competing for PIF set-aside funds within OSD. To be eligible for PIF money, proposals must: cost at least one hundred thousand dollars; produce sufficient operation and maintenance and/or personnel savings to offset total investment cost (amortize) within four years or less. Projects may be approved by OSD for incremental funding for up to three successive fiscal years.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,980	6,139	4,330		Continuing	N/A

EXPLANATION (U): FY 1985 funding was reduced by congressional budget action. FY 1986 funding changed with the approval of new projects.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands) Not Applicable.

5. (U) RELATED ACTIVITIES: Not Applicable.

6. (U) WORK PERFORMED BY: Air Force Systems Command manages these projects. The FY 1986 Productivity Investment Fund (PIF) effort is managed by Arnold Engineering and Development Center, Arnold Air Force Station, Tennessee; Armament Division, Eglin Air Force Base, Florida; and Human Resources Laboratory, Brooks Air Force Base, Texas.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

A. (U) Project Description: FY 1986 funded projects consist of two efforts begun in FY 1985 which continue in FY 1986, and four new efforts which begin in FY 1986.

(1) Plant Automation for Arnold Engineering and Development Center is funded in FY 1985 through FY 1987. This project will upgrade obsolete, unreliable, and energy inefficient instrumentation and control systems in the wind tunnel test facilities. The new computer based systems for control of plant operations will save energy and reduce contract labor costs. The payback period is 1.32 years.

(2) Propulsion Wind Tunnel Pretest System for Arnold Engineering and Development Center is funded in FY 1985 and FY 1986. This project will provide equipment to allow test article instrument and control systems to be checked prior to setting them up in the wind tunnel. Savings from reduction in overtime and fewer test reruns produce a payback period of 0.42 years.

(3) Office Automation II for Armament Division is a new project funded in FY 1986. This project supports improved and more timely management decisions by providing computer capability to extract, sort, collect, and analyze document data. By reducing the manual effort involved, the project produces a 0.36 year payback period.

(4) Pressure Measuring System for Arnold Engineering and Development Center is also funded in FY 1986 and 1987. By replacing the existing slow and inefficient pressure measuring system, turbine engine test time will be reduced. The payback period is 0.94 years.

(5) Flexibile Nozzle at Arnold Engineering and Development Center is funded in FY 1986 and 1987 to provide a flexible wind tunnel nozzle to permit full coverage from Mach 1.3 to 2.0. Performance above Mach 1.3 is currently limited to either Mach 1.6 or 2.0. The flexible nozzle will enable efficient test over the full range for fighter aircraft. The payback period is 1.44 years.

(6) Office automation System for the Air Force Human Resources Laboratory is funded in FY 1986. A distributed, computer-based, turn-key office automation system will replace and expand the present word processing system. It will contribute to more efficient management of Research and Development information resources. Manpower savings produce a 0.98 year payback period.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: FY 1984 approved and funded subprojects were the following: (1) a television ordnance range scoring system; (2) a word processing system for Armament Division; (3) an information management system for Electronic Systems Division; and (4) an administrative automation system for Headquarters, Air Force Systems Command. The four-year return on the $2 million investment is over $14 million.

(2) (U) FY 1985 Program: Three projects are funded in FY 1985. Armament Laboratory Shop Equipment for Armament Division will replace old equipment in the Prototype Fabrication Model Shop with two numerical controlled machines. The new machines will produce higher quality parts in less time for a four-year savings of $3.5 million on an investment of $338,500. The other two projects -- Plant Automation and Propulsion Wind Tunnel Pretest System -- are continued in FY 1986 as described above.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: As described above, two FY 1985 projects are continued in FY 1986, and four new projects begin. Within four years, these four new FY 1986 projects will return in savings 3.6 times their investment cost.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65874F
DOD Mission Area: #490 - Production Base Support

Title: Product Performance Agreement Center (PPAC)
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	.975	1,175	Continuing	N/A
3168	Product Performance Agreement Center	0	0	.975	1,175	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: It has long been the policy of DOD and the Air Force to acquire cost-effective warranties, guarantees, and similar incentive agreements on our weapon systems and their components. Recently enacted congressional language (10 U.S.C. 2403) requires use of guarantees on all weapon systems acquired henceforth. The Product Performance Agreement Center (PPAC) assists Air Force acquisition managers in the complex task of selecting, negotiating and implementing these business arrangements designed to incentivize contractor development of reliable, maintainable weapon systems. This is a new program element (PE) in FY 1986.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Funding of PPAC in prior years has been as an unfunded requirement by Air Force Systems Command.

6. (U) WORK PERFORMED BY. The operation of PPAC at Wright-Patterson AFB, OH will be largely a Government function performed by a permanent staff of Air Force military and civilian personnel. The Center is currently supported by The Analytic Sciences Corp (TASC), Reading, MA. The TASC contract will be completed in September 1985. A follow-on contract will be competitively awarded to allow continued support of the PPAC mission in FY 1986-FY 1990.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3168, Product Performance Agreement Center

Program Element: #65874F
DOD Mission Area: #490 - Production Base Support

Title: Product Performance Agreement Center (PPAC)
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) Project Description: The selective application of warranties, guarantees, and contractual incentives designed to encourage reliable, maintainable, high quality weapon systems has been Air Force policy for many years. However, Audit and Air Force Inspector General reports have highlighted the need for a center of expertise to ensure correct application, implementation and administration of these complex arrangements. Recent statutory language requiring the application of guarantees to all weapon systems has compounded the need for such a center. The Product Performance Agreement Center (PPAC) is designed to fulfill that need.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: PPAC was funded by Air Force Systems Command (AFSC) as an unfunded requirement in FY 1984. During that period, they continued development of an automated decision support system begun in FY 1983 to assist Program Offices in the selection of appropriate performance agreements and the analysis of the cost/benefits of each potential agreement. PPAC also directly supported many Air Force programs in developing agreements tailored to each program, and conducted a Product Performance Agreement Symposium in June. In addition, at the request of the Deputy Secretary of Defense and the Joint Logistics Commanders, PPAC initiated a study of the potential for establishing PPAC as a DOD-wide, or joint service center rather than an Air Force only Center.

(2) (U) FY 1985 Program: PPAC will again be funded by AFSC as an unfunded requirement in FY 1985. PPAC will continue automation of the decision support system begun in FY 1983 with a target date of October 1985 for full implementation of the initial system. They will also continue to provide the detailed technical assistance to Air Force program offices necessary to fully implement 10 U.S.C. 2403 weapon system guarantees. In addition, they will assist in implementing the much broader Air Force policy of considering product performance agreements on all acquisitions to incentivize contractors to further improvements in the reliability and maintainability of weapon systems and components. The DEPSECDEF directed study will be concluded in FY 1985, and a number of other studies in the area of Air Force-wide warranty/guarantee administration and cost-effectiveness will be conducted.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In FY 1986, PPAC is planned to be in full operation with the completion of the initial decision support system automation. Continued expansion and refinement of models in FY 1986 is planned, as well as the automation of its data repository function. With the development of these analytical tools, and the planned full complement of staff in FY 1986, PPAC will become more directly and deeply involved in a much larger number of weapon system programs, and in the development and implementation of policy guidance required to assure effective implementation and administration of performance agreements. It is anticipated there will be a continuing need for a technical support contractor to provide updating of the decision support system models, development of more sophisticated models, and performance of lengthy and detailed analysis of selected contractual and business arrangements. If, as a result of FY 1984/1985 DEPSECDEF review, the PPAC mission is revised to include all services, additional resource may be required.

The cost estimate was developed by the Product Performance Agreement Center (PPAC) in May 1984 based on the level of mission support they expect to conduct in FY 1986. This includes direct technical support to program offices, Air Force directed studies and analysis, expansion and refinement of computer based analytic tools, conduct of briefings and symposia, and publication of various technical reports and analysis for Air Force-wide use. The estimate also includes contractor technical support cost projections based on the estimated level of effort required to fully support their mission. This is a category IV estimate.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not applicable.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35110F
DOD Mission Area: #410 - Space Launch and Orbital Support

Title: Satellite Control Facility
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Estimate	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		71,725	93,000	83,122	84,331	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is the maintenance of a highly reliable national satellite tracking, telemetry and commanding (TT&C) capability to support the development and operation of DOD satellite systems. The Air Force Satellite Control Facility (AFSCF) is a global network of instrumentation systems, antennas, communications, and data processing equipment required to support a growing inventory of increasingly complex space vehicles.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	71,725	99,224	53,850		Continuing	N/A
Aircraft Procurement	1,567	307	0		Continuing	N/A
Other Procurement	7,657	9,941	30,715		Continuing	N/A

Changes in FY 85 RDT&E were the result of a Congressional reduction and will result in a delay in transition of programs from the current operating system to the Data System Modernization (DSM) operating system.

Changes in FY 86 RDT&E were required to reflect programmatic increases in the DSM program resulting from increasing software development and complexity; to restructure development and procurement funds for the Advanced Remote Tracking Station (ARTS) program based on an independent cost estimate; and to replace funds taken by the FY 85 Congressional action.

Changes in FY 86 Other Procurement were required for hardware procurement in support of the DSM program.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Aircraft Procurement	1,567	307	2,083	500	Continuing	N/A
Other Procurement	7,657	9,941	47,256	75,197	Continuing	N/A
Military Construction	0	3,000	12,100	6,288	Continuing	N/A
Operations and Maintenance	80,259	107,051	119,876	115,784	Continuing	N/A

5. (U) RELATED ACTIVITIES: Both Defense Communications System (DCS) and non-DCS telecommunications program activities relating to the Satellite Control Facility (SCF) are contained in Program Element (PE) 35151F (SCF Telecommunications). Real property maintenance activities relating to the SCF are contained in PE 35894F (Real Property Maintenance, AFSC). SCF base operating support is contained in PE 35896F (Base Operating Support, AFSC). The majority of DOD satellite programs rely, to varying degrees, on the SCF for support. The Defense Meteorological Satellite Program (DMSP), PE 35160F, and the SCF will cooperate to install an interoperable TT&C antenna at the Thule Remote Tracking Station, provide a backup control center for DMSP, and close the DMSP Loring AFB Command Readout Station. The Global Positioning System (GPS), PE 35165F, and the SCF will cooperate to assure interoperability between GPS Ground Antennas and SCF Remote Tracking Stations, and provide a backup to the GPS Master Control Station at the Satellite Test Center (STC). The Consolidated Space Operations Center (CSOC), PE 35130F, will provide increased capability and survivability by sharing the control functions of the STC. CSOC will also provide control of DOD shuttle missions. The SCF and CSOC are providing mutual support to each other through their use of common hardware and software. Two current examples that will lead to compatibility and interoperability between these agencies are Data System Modernization (contracted by the SCF) and the Communications Upgrade (contracted by CSOC).

6. (U) WORK PERFORMED BY: Air Force management of this national capability is under Space Division, Los Angeles AFS, CA. Principal contractors are: Lockheed Missile and Space Company (LMSC), Sunnyvale CA, which provides study and development sustaining engineering for the STC; Ford Aerospace Communications Corporation (FACC), Palo Alto, CA, which provides study and development analysis for the Remote Tracking Stations (RTS); System Development Corporation, Santa Monica, CA, which provides computer system integration; Ultrasystems, San Jose, CA, which provides systems engineering, integration and test analysis; IBM Corporation, Gaithersburg, MD which was awarded the development/acquisition contract for the Data Systems Modernization program and Ford Aerospace Communications Corporation (FACC), Palo Alto, which was awarded the development/acquisition contract for the Advanced Remote Tracking Station program. In addition to RDT&E support, LMSC, FACC, and other contractors provide operations and maintenance support for the network.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35110F, Satellite Control Facility

A. (U) Program Description: The Satellite Control Facility is a world-wide network consisting of a Headquarters at Sunnyvale, CA; seven geographically dispersed tracking stations; a communications satellite calibration site at Camp Parks, CA; a control center (the Satellite Test Center at Sunnyvale); and a satellite recovery group at Hickam AFB, HI. The mission of the SCF is to provide tracking, real-time telemetry, commanding, and recovery of Department of Defense space vehicles operating in a multi-satellite environment. The SCF supports satellites

operating with various orbital parameters to accomplish diversified test and operational objectives for the Air Force, Navy, other DOD agencies, the National Aeronautics and Space Administration, and the North Atlantic Treaty Organization. Support commences prior to launch and, in most cases, continues throughout the life of the satellite to include recovery, if required. A complex instrumentation system consisting of antennas, communications, and data processing equipment provides the ground support capabilities for the many space vehicles. The RDT&E appropriation provides for the development, installation and modification of network components to meet evolving satellite program support requirements. These efforts either correct system deficiencies or allow for increased program support.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: In FY 1984, the network supported an average of 55 satellites on-orbit simultaneously. This average is continuing to increase as is the overall Satellite Control Facility (SCF) workload which is expected to increase to 59 satellites by 1985. This expanding workload is primarily the result of a larger force structure, the increasing complexity of spacecraft and space operations, and support of Space Transportation System (STS) launches. Data System Modernization (DSM) development has proceeded satisfactorily with completion of 66% of the new software and delivery of hardware for installation in the first mission control centers. The Advanced Remote Tracking Station (ARTS) contract was awarded to Ford Aerospace in June 1984. ARTS material for site preparation at the Thule Tracking Station, Greenland has been shipped. The Consolidated Space Operations Center (CSOC) continued the competition for the communication contract that will provide compatible systems to both CSOC and the SCF.

(2) (U) FY 1985 Program: The Satellite Control Facility will continue its three phase upgrade to the Satellite Control Network. This consists of the planning, development, acquisition, operation and maintenance of systems necessary to support the needs of current and planned space programs. DSM will continue development of software modules and hardware deliveries for both mission control centers and remote tracking stations. The second new facility supporting DSM will reach its beneficial occupancy date in early FY 1985. ARTS, Thule Tracking Station site preparation and Colorado Tracking Station construction will proceed in FY 1985. The CSOC communications contract was awarded in November 1984. This contract will provide the communications capability at CSOC compatible with hardware provided to the SCF to insure interoperability between these two control nodes.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Ongoing efforts to meet evolving satellite program requirements will continue. The most significant portion of FY 1986 RDT&E will be the transition of operational satellite programs from the existing configuration to the new DSM configuration. The first such transition is scheduled for January 1986 with the last transition scheduled for September 1987. DT&E for the ARTS Thule Tracking Station will begin. Communications compatibility testing will begin between the SCF and CSOC. Cost estimates for DSM are based on a competitive contract awarded in December 1980 with a single best estimate update in 1983. ARTS and Communications estimates are based on independent cost estimates conducted by the Aerospace Corporation (support contractor to Space Division) in 1983.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Data System Modernization (DSM) Contract Award		December 1980
(2)	(U)	DSM Military Construction		March 1983
(3)	(U)	DSM DT&E		October 1983
(4)	(U)	Advanced Remote Tracking Station (ARTS) Contract Award	*(March 1984)	June 1984
(5)	(U)	Consolidated Space Operations Center Communications Contract Award		November 1984
(6)	(U)	DSM OT&E		January 1985
(7)	(U)	DSM IOC		January 1986
(8)	(U)	ARTS-Thule Tracking Station Initial Operational Capability (IOC)		September 1987
(9)	(U)	DSM-Full Operational Capability		September 1987
(10)	(U)	ARTS-Colorado Tracking Station IOC	*(December 1986)	June 1988
(11)	(U)	ARTS-Northern Europe Tracking Station IOC		September 1988

(U) EXPLANATION OF MILESTONE CHANGES:

(4) (U): Administrative delay in award of contract

(10) (U): Reordering of ARTS and item deliveries to reflect development and operational need dates

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35119F
DOD Mission Area: #410 - Space Launch and Orbital Support

Title: Space Boosters
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		15,441	15,356	221,393	191,805	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The need exists to provide a continuing, highly reliable means of placing critical Department of Defense satellites into their required mission orbits. Providing an assured access to space will be accomplished through the use of a robust mix of existing expendable launch vehicles (ELVs), the Space Transportation System (STS), a complementary expendable launch vehicle system to the STS, and the Titan II space launch vehicle (SLV) system. The Space Boosters program provides for the procurement, engineering support, and flight performance assessment of the Department of Defense expendable launch vehicles. This program also provides the resources for Titan III(34)D/Transtage launches at the Eastern Test Range, and for Atlas-E launches of Air Force satellites from the Western Test Range. This program will begin the development of the Complementary ELV system in FY 1985, and begin the conversion of the Titan II Intercontinental Ballistic Missiles (ICBMs) into a space launch vehicle configuration in FY 1986.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	15,441	20,356	8,962		Continuing	N/A
Missile Procurement	0	25,310	6,911		Continuing	N/A

RDT&E: Funds are added in FY 1986 to continue the development of an upgraded expendable launch system capable of launching large, Shuttle-sized satellites. This Complementary Expendable Launch Vehicle (CELV) system will be used to provide an assured access to space for critical DOD satellites beginning in October 1988.

Funds are also added in FY 1986-90 to begin conversion of Titan II ICBMs for use as Space Launch Vehicles (SLVs). After these modifications, this new system will launch the Defense Meteorological Satellite Program (DMSP) and a classified satellite program beginning in FY 1990. This Program Element will be responsible for funding the non-recurring design and launch services costs for the Titan II SLV program. Refurbishment costs and program specific items will be funded by the appropriate satellite program.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement						
Funds	0	25,200	126,894	227,308	Continuing	N/A
Quantities	0	0	7*	0		
Operations & Maintenance						
Funds	75,956	91,566	100,015	55,573	Continuing	N/A

* First year of incrementally funded procurement. Three additional vehicles will be funded by a classified program.

5. (U) RELATED ACTIVITIES: Major Department of Defense and National Aeronautics and Space Administration space systems which employ the Atlas and Titan III boosters include: classified space programs; Defense Satellite Communications System, Program Element 33110F; Defense Meteorological Satellite Program, Program Element 35160F; Defense Support Program, Program Element 12431F; Navstar Global Positioning System, Program Element 35165F; Navy Geodetic Satellite (GEOSAT); and the National Oceanic and Atmospheric Administration (NOAA) polar orbiting meteorological satellite program. Western Test Range launched Titan vehicles are funded by a classified program element, but the operation is managed by this program element. The DOD satellite programs planned to be compatible with both the Space Shuttle and Complementary ELV are the Defense Satellite Communications System, the Defense Support Program, Milstar, and a classified program. The DOD satellite programs planned for use on the Titan II Space Launch Vehicle are the Defense Meteorological Satellite Program and a classified program.

6. (U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command Space Division, Los Angeles, Air Force Station, CA. Systems Engineering is provided by Aerospace Corporation, El Segundo, CA. Titan III contractors include: Martin Marietta Corporation, Denver, CO (integration, core vehicle, Transtage); Aerojet Liquid Rocket Company, Sacramento, CA (liquid propulsion system); and United Technology Corporation-Chemical Systems Division, Sunnyvale, CA (solid rocket motors). Atlas contractors include: General Dynamics - Convair, San Diego, CA (integration and airframe) and Rocketdyne, Canoga Park, CA (liquid propulsion systems). Contractors for the new Complementary Expendable Launch Vehicle and the Titan II Intercontinental Ballistic Missles conversion have not been selected.

7. (U) PROJECT LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35119F, Space Boosters

A. (U) Project Description: The Department of Defense family of space boosters (Atlas, Thor, Titan III) was developed to provide a versatile capability for meeting national launch requirements. The family includes two decommissioned ballistic missile types (the Atlas-E and Thor vehicles) upgraded for space launch support. This Program Element provided for development of the Titan III Space Launch Vehicle, provides continuing support for the Atlas and Titan III launch vehicles, and provides storage for the nine remaining Thor launch vehicles. The boosters supported by this program are:

Atlas-E - refurbished Atlas Intercontinental Ballistic Missile (ICBM), radio guided, liquid rocket engine propelled.

Titan III(34)B - modified Titan II first and second stages with liquid rocket engines (core vehicle) flown with an Agena upper stage and either radio or inertial guidance; flown only from Vandenberg AFB, CA.

Titan III(34)D/Transtage - Titan III(34)D flown with the Transtage upper stage; guidance provided by the Transtage inertial guidance system; flown only at Cape Canaveral Air Force Station, FL.

Titan III(34)D - radio guided version of the Titan III(34)D which is flown without the Transtage Upper Stage and is flown only at Vandenberg AFB, CA.

Thor - refurbished Thor Intermediate Range Ballistic Missile (IRBM), programmer guided, liquid rocket engine, single stage - in storage.

Complementary ELV - configuration is currently in source selection, will be required to launch a 10,000 lb satellite into geosynchronous orbit from the east coast.

Titan II SLV - refurbished ICBM, inertial guidance, liquid rocket engine, to be launched only at Vandenberg AFB, CA.

(U) The program also includes post flight analysis, study, modification, redesign and test to correct deficiencies; evaluation and improvement (where warranted) of mission reliability; component reliability improvement to prevent launch vehicle failures; and analysis support and development planning for new missions on these existing boosters. The program provides for integration of the Transtage onto the Titan III(34)D to assure the ability to launch critical Department of Defense missions from the Eastern Test Range. The program also provides Atlas-E launch services for medium weight Air Force satellites launching from Vandenberg AFB, CA. In FY 1985, the program will begin the development of an expendable launch vehicle which will be used as a complement to the Space Shuttle for

selected national security satellite programs. In FY 1986, the program will begin to convert the Titan II ICBM for use as a space launch vehicle to support the Defense Meteorological Satellite Program (DMSP) and a classified program.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The basic Titan III and Atlas reliability maintenance flight assessment vendor qualification and component/subsystem replacement efforts continued. Two Titan III(34)D/Transtages launched operational payloads. Three Atlas-Es were launched; two of them carried NAVSTAR Global Positioning System (GPS)/ Nuclear Detonation Detection System (NDS) research and development missions, and one launched a Defense Meteorological Satellite Program (DMSP) Block 5D-2 mission. A request for proposal (RFP) was issued calling for the competitive acquisition of a complementary expendable launch vehicle system capable of placing a 10,000 pound satellite into geostationary orbit. This system will be used to complement the Shuttle.

(2) (U) FY 1985 Program: The basic Titan III and Atlas reliability maintenance, flight assessment, vendor qualification and component/subsystem replacement efforts will continue. Two Titan III(34)D/Transtages will be launched. Four Atlas launches are planned, one for GPS, one for DMSP, one for a National Oceanic and Atmospheric Administration (NOAA) polar weather satellite, and one for the Navy Geodetic Satellite (GEOSAT). The NOAA and Navy launches are funded on a cost reimbursement basis. Also during FY 1985, the program will begin the development of an expendable launch vehicle capable of placing 10,000 pounds into geostationary orbit. This vehicle will be used as a complementary system to the Space Shuttle for critical national security programs. Ten vehicles will be acquired (seven by this Program Element, three by a classified program) for a launch rate of approximately two per year for five years beginning in late 1988.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The basic Titan III and Atlas reliability maintenance, flight assessment, vendor qualification and component/subsystem replacement efforts will continue. Three Atlas and two Titan launches are planned. Development of the Complementary Expendable Launch Vehicle (CELV) will continue and production will begin. Beginning in FY 1986, the program will begin development efforts to convert the Titan II ICBM into a Space Launch Vehicle (SLV). Initial launch capability (ILC) of the Titan II SLV will occur in FY 1990 to support DMSP and a classified satellite program. The cost estimating techniques used for the Space Boosters program are based on a large historical data base, contractor estimates, and program office cost models.

(4) (U) Program to Completion: This is a continuing program. The basic Titan III and Atlas reliability maintenance flight assessment, vendor qualification, and component/subsystem replacement efforts will continue until the existing Titan III and Atlas vehicles have been launched. The program will continue to require funds from other appropriations to support operational Titan III and Atlas launches, to maintain critical Titan III support capability, and to phaseout certain Titan III configurations. Acquisition of the CELV effort will continue, leading to a first flight in late 1988. The Titan II SLV will continue development and conversion efforts leading to an initial launch capability in FY 1990.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	Titan III(34)D Initial Launch Capability at Vandenberg AFB, CA		December 1981
(2)	(U)	Titan III(34)D/Inertial Upper Stage Initial Launch Capability at Cape Canaveral AFS, FL		October 1982
(3)	(U)	Titan III(34)D/Transtage Initial Launch Capability at Cape Canaveral AFS, FL		December 1982
(4)	(U)	Initiate Titan III production phaseout		April 1983
(5)	(U)	Titan III (34D) production terminated		June 1983
(6)	(U)	Initiate Complementary ELV development and acquisition		February 1985
(7)	(U)	Initiate Titan II space launch vehicle development		1st Qtr FY 1988
(8)	(U)	Last Titan III (34D) launch from the Eastern Test Range	*(FY 1985)	FY 1988
(9)	(U)	Complementary ELV initial launch capability		October 1988
(10)	(U)	Titan II Space Launch Vehicle initial launch capability		FY 1990
(11)	(U)	Last Atlas E launch from Vandenberg AFB, CA		FY 1990

* Date presented in Fiscal Year 1985 Descriptive Summary

(U) Explanation of Changes:

(8) (U) Last Titan III (34)D launch was delayed due to a satellite program's decision to complete the assembly and launch of an additional Titan III(34)D booster which was cancelled in mid-production in June 1983.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35130F
DOD Mission Area: #410 - Space Launch and Orbital Support

Title: Consolidated Space Operations Center
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		65,173	65,698	87,415	96,093	191,111	566,578

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Consolidated Space Operations Center (CSOC) consists of two main elements: the Satellite Operations Complex (SOC) and the Shuttle Operations and Planning Complex (SOPC). The need for the satellite control capability (i.e., SOC) is based on the vulnerability of the Satellite Test Center (STC) in Sunnyvale, CA, which is a single node in the satellite control network which provides tracking, telemetry, and command capabilities to satellites supporting various national security missions. The STC is vulnerable to both environmental and man-made threats and has limited growth potential. The need for the Shuttle control capability (i.e., SOPC) stems from the reliance on the Space Shuttle for DOD missions. The DOD Shuttle control capability at Johnson Space Center (JSC) does not meet all DOD requirements for planning and conducting DOD missions. The capacity at JSC is limited to no more than 12 secure DOD flights per year, security is limited to SECRET, and military and civil space operations are intermingled. JSC is also a single node, subject to hostile actions and environmental hazards. CSOC overcomes these limitations by providing: a secure environment from which to conduct DOD space missions; siting to minimize environmental and man-made threats; adequate capacity to support the national Shuttle traffic model; and the capability to conduct military space operations from dedicated DOD facilities allowing close coordination of Shuttle and satellite operations.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	70,677	72,696	89,289		170,806	453,199
Other Procurement	77,876	169,189	125,929		134,585	528,315

(U) RDT&E: FY 1984 funds were reprogrammed to other high priority programs. Changes in FY 1985 and 1986 are the net result of repricing increases based on better data and reductions due to a two year deferral of the SOPC activation. The Total Estimated Cost increases due to the resulting stretchout of SOPC development (+$66,200), to a zero balance transfer of funds from Other Procurement to RDT&E (+$40,900), and to better pricing data (+$6,279).

(U) Other Procurement: FY 1985 and 1986 reductions reflect the two year deferral of the Shuttle Operations and

Planning Complex (SOPC) activation. The Total Estimated Cost decrease reflects the zero-balance transfer of funds to RDT&E.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement						
Funds	77,876	138,700	34,912	113,828	120,921	506,973
Quantities	Not applicable					
Military Construction						
Funds	75,000	0	0	0	0	142,700

5. (U) RELATED ACTIVITIES: PEs 33112, Air Force Communications and, 33126F, Long Haul Communications, provide CSOC administrative communications. The Satellite Control Facility Data System Modernization project, funded under PE 35110F, Satellite Control Facility, will develop the CSOC satellite control complement of equipment. An interim DOD Shuttle control capability has been established at the Johnson Space Center (JSC) under PEs 64411F, Space Shuttle and 12449F, Space Shuttle. The CSOC Shuttle operations complement of equipment will be evolved from National Aeronautics and Space Administration (NASA) systems and the operational experience gained at the JSC under PE 35171F, Space Launch Support. Air Training Command participation in the CSOC operations training program is supported by portions of PEs 84731F, General Skill Training; 84751F, Professional Military Education; 84772F, Training Development; and 85796F Base Operations Training. Logistics support is provided as part of PE 71112F, Inventory Control Point Operations. Utilities and facility maintenance are included in PE 12894F, Real Property Maintenance.

6. (U) WORK PERFORMED BY: The CSOC System Program Office (SPO) is located at Space Division, Los Angeles Air Force Station, CA. The Army Corps of Engineers, Omaha, NE, is responsible for managing the construction of the CSOC facilities. The Shuttle control systems definition work is being performed with the assistance of NASA's Johnson Space Center, Houston, TX. The Aerospace Corp., El Segundo, CA, is providing the SPO with system engineering services while TRW, Inc., Redondo Beach, CA, is contracted to provide CSOC system integration services. The satellite control systems are being developed and produced by IBM at their Gaithersburg, MD facilities. Competitive design phase contracts for the communication segment have been completed by Ford Aerospace and Communications Corp., Colorado Springs, CO, and by Space Communications Company, Gaithersburg, MD. Space Communications Company has been awarded the communications acquisition contract. Competitive design phase contracts for Shuttle planning and control systems have been awarded to Ford Aerospace and Communications Corp., Colorado Springs, CO, and to IBM, Gaithersburg, MD. The facilities design work was completed by Holmes & Narver, Orange, CA. Schmidt-Tiago, Colorado Springs, CO, has

completed site preparation work, and Bechtel National Inc., San Francisco, CA, is constructing the Consolidated Space Operations Center (CSOC) facilities. Lockheed Space and Missile Company, Sunnyvale, CA, has been awarded a contract to provide positional training for both satellite and Shuttle operating personnel.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35130F, Consolidated Space Operations Center (CSOC)

A. (U) Project Description: The CSOC will be developed and activated in several phases. Each phase will result in an increment of added operational capability. CSOC facilities will be available for occupancy in October 1985. By April 1986, the facilities, utilities and communications will be operationally available to support the Global Positioning System (GPS) Master Control Station as the first CSOC occupant. The first satellite mission control center is projected to be operational in FY 1987. The mission control centers for other satellite programs will be sequentially activated during 1987 and 1988. To support the Shuttle flight schedule, as reflected in the national Shuttle mission model, the CSOC Shuttle Flight Planning Element is projected to be operational in 1989. The Shuttle Flight Readiness and Flight Control elements will be activated in time to provide a full year of crew training, rehearsals, and active flight following (in parallel with NASA operations) in order to validate CSOC operational readiness prior to the first CSOC controlled Shuttle flight.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The final phase of facility construction (buildings) was begun. Software development for the Satellite Operations Complex (SOC) continued. Competitive design efforts for communications systems were completed. Competitive contracts were awarded for the design of the Shuttle Operations and Planning Complex (SOPC) technical systems.

(2) (U) FY 1985 Program: The facility construction will be essentially completed. Software development for the SOC and competitive design efforts for the SOPC will continue. Acquisition contracts have been or will be awarded for the SOC, communications, and physical security systems. The operational training program will intensify with the development of course materials and procurement of training equipments becoming major efforts in FY 1985.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The CSOC facilities will be completed in early FY 1986. The year will be characterized by extensive system-level production, integration and installation of technical systems. Systems in production will include the satellite control hardware and software, the communication system, the network scheduling and control system and several support components such as the physical security and timing subsystems, and the operations command center. A contract will be awarded for the acquisition of Shuttle

planning and control systems. The operations training program will be running at surge capacity in order to prepare the operations and maintenance personnel for the pending Initial Operation Capability (IOC) of the Satellite Operations Complex (SOC). In a related effort, the operational test and evaluation team will begin conducting operational suitability testing. The RDT&E budget request is based on mature estimates. Approximately 85% of these estimates are derived from contracts currently in force, and valid contractor bids in response to Requests for Pro posals. The remainder of these estimates are based on an Air Force directed Independent Cost Analysis conducted in the fall of 1982. The difference in the current RDT&E funding profile, compared with the February 1984 President's Budget request, reflects the two year delay in Shuttle Operations and Planning Complex (SOPC) activation which resulted from the reduction of FY 1985 funds by Congress.

(4) (U) Program to Completion: In parallel efforts, technical systems will continue to be installed, integrated and checked out; operating personnel will be positionally qualified through team-level rehearsals; and initial segments of the operational test and evaluation program will be completed in preparation for the first satellite mission control center becoming operational in FY 1987. Equipment acquisition and installation will continue as mission control centers for additional satellite programs become operational in FY 1987 and 1988. The Shuttle control capabilities will be implemented in the late 1980s and early 1990s.

C. (U) Major Milestones:

	Milestones		Dates
(1)	(U) Mission Element Need Statements Validated		September 1979
(2)	(U) Environmental Impact Analysis Filed		February 1981
(3)	(U) Site Selection Announcement		March 1981
(4)	(U) Construction Start		May 1983
(5)	(U) Facility Occupancy		October 1985
(6)	(U) Global Positioning System Capability		April 1986
(7)	(U) First Satellite Mission Control Center Operational	*(December 1986)	February 1987
(8)	(U) Begin Transition of Shuttle Operations to the CSOC	*(December 1987)	August 1989

* Date presented in Fiscal Year 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

(7) Delayed as a result of the reduction in FY 1985 funding.

(8) Delayed as a result of the reduction in FY 1985 funding.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35160F Title: Defense Meteorological Satellite Program (DMSP)
DOD Mission Area: #410 - Space Launch and Orbital Support Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		22,971	42,552	71,309	65,790	Continuing	N/A

2. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Meteorological Satellite Program (DMSP) provides visual and infrared cloud cover data and other meteorological, oceanographic, and solar-geophysical information. These data are required over the entire surface of the earth in support of strategic and tactical missions. [ ]satellites are required in polar orbit at all times; each providing coverage of the whole earth every 12 hours. Program requirements were revalidated by the Joint Chiefs of Staff on 5 October 1981. The operational Commanders-in-Chief have strongly stated their requirement for an operational DMSP in their semiannual situation reports. This Program Element provides the satellites and sensors, ground command and control, Air Force mobile tactical ground terminals, operations and maintenance, and booster modifications.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	25,270	42,566	76,651		Continuing	N/A
Missile Procurement	33,608	139,909	58,121		Continuing	N/A
Other Procurement	10,961	33,740	18,995		Continuing	N/A
MILCON	0	5,700	0		0	5,700

(U) RDT&E: FY 1986 funds were reduced due to direction to change from the Space Shuttle to refurbished Titan II Intercontinental Ballistic Missiles (ICBMs) as satellite launch vehicles for launches in FY 1990-95. Funds were transferred to the Space Boosters Program Element (PE 35119F) or converted to other appropriations to fund Titan II refurbishment, modification, and launch. Reduced Federal Contract Research Center (FCRC) support to the DMSP program accounts for an additional $1 million reduction for FY 1986.

(U) OTHER PROCUREMENT: FY 1986 funds were reduced due to a reduction in procurement quantities of mobile tactical receiving terminals.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Estimate	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement:						
Funds	33,408	139,400	53,979	45,063	Continuing	N/A
Quantities	0	2	0	0		
Other Procurement:						
Funds	13,361	32,758	13,577	6,468	Continuing	N/A
Quantities	Not Applicable					
Military Construction:						
Funds	0	5,700	0	0	Continuing	N/A

5. (U) RELATED ACTIVITIES: The Defense Meteorological Satellite Program (DMSP) is a joint-Service program in accordance with the Memorandum of Agreement on Joint Service Management and Operations of DMSP dated 15 December 1976. The program supports all military services. Based on the successful operation of an experimental receiving terminal aboard the U.S.S. Constellation, the Navy is equipping all large carriers to receive data and is operating two shore based terminals to receive data (PE 35160N provides funding to the DMSP program office). The related Naval Remote Ocean Sensing System (N-ROSS) satellite development is also funded in PE 35160N. Through the DMSP program office, the Marine Corps has procured one RDT&E model of the new Air Force developed transportable terminal and began production procurement of six units in FY 1982. Navy personnel are integrated into the program office to insure compatibility between the Air Force developed satellites and the receiving and data processing equipment of the Navy and Marine Corps. A Special Assistant for Air Force/Army represents these service users within the program office. Close coordination is also maintained with the civilian weather satellite program operated by the Department of Commerce (DOC). The two systems have different primary missions and different primary sensors. Cloud imagery is the primary DOD need, while vertical temperature soundings are the primary DOC need. Interchange of technology has been continuous, with special emphasis on avoiding duplication of effort. Pursuant to a study directed by the Office of Management and Budget (OMB), DOC was directed in January 1974 to adopt the DOD spacecraft design, the Block 5D, as the basic spacecraft bus for the civil system. In July 1984, OMB directed that DOC continue to fly this design on expendable launch vehicles until the Air Force transitions the DMSP satellite to Shuttle, then participate in a common development of the new satellite. Atlas E launch services for the DMSP are provided by the Space Boosters Program (PE 35119F). Leased communications are provided for the DMSP command and control element by DMSP Communications (PE 35162F). The DMSP and the Air Force Satellite Control Facility (PE 35110F) will cooperate to install an interoperable telemetry, tracking, and control (TT&C) antenna at the Thule

Remote Tracking Station via the Advanced Remote Tracking Station (ARTS). This initiative, in conjunction with other command and control upgrades, will allow closure of the dedicated DMSP Command Readout Station at Loring AFB, ME in FY 1989.

6. (U) WORK PERFORMED BY: Development and procurement are managed by Space Division, Los Angeles AFS, CA. The Air Force Geophysics Laboratory, Hanscom AFB, Bedford, MA; the Aerospace Corporation, El Segundo, CA; and the Navy's Environmental Prediction Research Facility, Monterey, CA all contribute to the DMSP satellite meteorology development program. Contractors include: RCA, Princeton, NJ (spacecraft and satellite integration); Westinghouse Electric Corporation, Baltimore, MD (primary imaging sensor); Hughes Aircraft Company, Los Angeles, CA; Barnes Engineering Company, Stamford, CT; Aerojet Electro-Systems, Azusa, CA; Sandia National Laboratories, Albuquerque, NM (mission sensors); Harris Corporation, Melbourne, FL (ground command and control and mobile ground data processing terminals); General Dynamics Convair, San Diego, CA (launch vehicle) (modification managed under PE 35119F); American Satellite Corporation, Rockville, MD (commercial communications data relay for PE 35162F); and General Electric Company, Lanham, MD (Hardcopy Image Processing System for Air Force Global Weather Central).

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35160F, Defense Meteorological Satellite Program

A. Project Description: The DMSP is a joint-Service program in accordance with the Memorandum of Agreement on Joint Service Management and Operations of DMSP, dated 15 December 1976. The program supports all military services. The DMSP provides visual and infrared cloud cover data and other meteorological, oceanographic, and solar-geophysical information. These data are required over the entire surface of the earth in support of strategic and tactical missions. [ ]satellites are required in sun synchronous polar orbit at all times, each giving coverage of the whole earth every 12 hours. (Sun synchronous means that the satellite crosses the equator, going north, at the same local time on each of its 14 orbits/day.) [ ] This Program Element provides the satellites and sensors; ground command and control facilities and personnel; Air Force fixed and mobile tactical ground terminals; operations and maintenance; and booster modifications. The Navy is equipping all large carriers to receive data and is operating two shore based terminals to receive data. These are procured through the DMSP program office. The Air Force began procurement of new tactical terminals (Mark IVs) in FY 1978 with the acquisition of one RDT&E model and three production models that have been operationally deployed. Air Force follow-on production procurement of six terminals began in FY 1984. These six terminals will replace six Mark IIA and III terminals, procured in the 1960s, that are currently deployed worldwide. The remaining seven will be extensively modified to make them supportable until they are replaced in the late 1980's. The Marine Corps, through the DMSP program office, has procured one RDT&E Mark IV and began production procurement of six units in

FY 1982. This PE provides funding for all Air Force Logistics Command support for the program through the Sacramento Air Logistics Center. In FY 1984, the Air Force and DOD directed the DMSP to continue to use expendable launch vehicles (ELV) until a Shuttle optimized satellite is developed. The directed ELV is the Titan II Intercontinental Ballistic Missile (ICBM) being removed from operational status. The use of Titan II as a launch vehicle will cover mission replacement needs at a large cost savings until the development and qualification of a fully Shuttle optimized satellite is completed. The Titan II effort will also provide a good basis for developing requirements and specifications for the Shuttle optimized satellite.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: There was one new RDT&E initiative in FY 1984. DMSP began development of a passive microwave moisture sounder that will be used to determine the amount of water vapor in the atmosphere. These data are especially important for supporting use of infrared guided weapons. DMSP continued the design and production of a primary (cloud imaging) sensor. By the end of FY 1984, almost all parts had been received and the assembly and test of the unit had begun. The satellite reliability and design improvement effort, started in FY 1982 completed the design phase. Parts were tested and qualified for future incorporation on Defense Meteorological Satellite Program satellites. The ground command and control system was upgraded to minimize data handling time and to improve operator hardcopy and video displays. This will improve real-time telemetry analysis and anomaly resolution. Designs for including command telemetry and stored data playback encryption systems on the satellite were finalized. The first fully encrypted satellite was assembled and is scheduled for delivery in the summer of 1985. The Hardcopy Image Processing System (HIPS) completed its second year of development. Efforts began to study use of Titan II ICBMs as the DMSP primary booster.

(2) FY 1985 Program: The assembly of the primary (cloud imaging) sensor will be completed and subsystem qualification testing will begin. Actual design and development of the Titan II qualified DMSP satellite will begin, with work to be conducted through FY 1990. This effort will include the design, development, and qualification of the spacecraft itself, as well as the integration of all the sensors. Development of a secondary sensor to define the state of the ionosphere in support of critical national radar and radio communications programs will begin. This sensor will first be flown in the early 1990s. Preliminary concepts for an active laser radar (LIDAR) sensor for measuring wind speed and atmospheric aerosol content will begin. Production of the microwave moisture sensors will begin in FY 1985, based on the FY 1984 design effort. The Hardcopy Image Processing System (HIPS) will be delivered. Design and development of a shutter to protect the imaging sensor's infrared (IR) channel against laser damage will begin. This shutter is intended to protect the IR sensor against destruction caused by low level illumination [ ] The shutter will be designed to allow retrofit onto existing, unlaunched sensors. The final funding for the multiyear contract, initiated in FY 1983, for the assembly of two spacecraft and primary (cloud imaging) sensors will be provided. Construction by the Air Force Satellite Control Facility (AFSCF) of a new antenna facility (Advanced Remote Tracking Station) at Thule Tracking Station, begun in FY 1984, will continue in FY 1985 and be completed in FY 1988. While the antenna will

be an AFSCF resource, DMSP will have priority use. In concert with this AFSCF development, construction of a hardened command and control and data relay facility at Fairchild AFB, WA, will begin. This building is intended to protect DMSP's command and control capability against collateral damage from nuclear strikes and provide backup against outages of the existing command and control facility. The building will be occupied in FY 1988. After completion and checkout of the Fairchild and Thule facilities, the existing dedicated command and control facility at Loring AFB, ME will be closed.

(3) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The Defense Meteorological Satellite Program (DMSP) will continue the programs begun in previous years. The Titan II compatible satellite will be in the second year of development and the primary (cloud imaging) sensor will begin system level qualification testing. The ionospheric sensor and wind laser radar (LIDAR) sensor development will continue. Laser hardening of the satellite and primary sensor to a goal of [ ] against low altitude satellites in the late 1980s to mid-1990s will begin. Work done in earlier years to develop satellite computer software to improve satellite autonomy will allow development of hardware and hardware/computer interfaces to incorporate autonomy capabilities to begin. These survivability modifications will be implemented on Titan II compatible satellites. Production efforts begun in earlier years will continue. These include the multi-year procurement of four satellites begun in FY 1983 and 1985, the command and control system upgrade (shared Thule command and control facility and the hardened satellite operations center near Fairchild AFB, WA), and the microwave moisture sounder. The funding request is based on awarded, ongoing contracts, contractor proposals, or contractor estimates. The survivability hardware and software estimates are based on several years of preliminary development. The confidence in the cost estimates ranges from Comprehensive (Level I) to Budgetary (Level III) depending on the maturity of the individual effort.

(4) (U) Program to Completion: This is a continuing program. The DMSP will complete qualification of the imaging sensor and integration onto the Titan compatible satellite. The program will continue development of a Titan II compatible spacecraft that was begun in FY 1985, allowing a transition to Titan II in FY 1990/1991. Upgrades to the spacecraft and sensors will continue to take advantage of developing technology, allowing the system to better meet the validated requirements of the special strategic missions, the joint-Service mission, and the Joint Chiefs of Staff. The DMSP spacecraft and primary (cloud imaging) sensor will incorporate laser hardened components into the production line. This will improve the survivability of the system against the known and projected laser threat. Development of the ionospheric sensor and the LIDAR wind sensor will continue. Construction by the Air Force Satellite Control Facility (AFSCF) of a new antenna facility at Thule Tracking Station which will begin in FY 1985 will be completed in FY 1988. While an AFSCF resource, DMSP will have priority use of the Thule antenna. Construction of a hardened command, control, and data relay facility at Fairchild AFB, WA, will continue, with a completion date of FY 1988. The dedicated command and control facility at Loring AFB, ME will be closed in FY 1989. Production of the Mark IV transportable terminals, begun in FY 1984, will continue through FY 1986. Design and pr duction of transportable tactical terminals to replace the last six 1960's units will begin in FY 1988. Procurement of replen-

satellite will begin in FY 1988 with the first flight in 1995. This satellite will have increased performance and support more of the validated Joint Chiefs of Staff requirements. Additionally, the satellite will incorporate increased survivability and autonomy capabilities to protect it against the anticipated Soviet threat. Improved operational support flexibility will also result from Shuttle optimization.

C. (U) Major Milestones:

	Milestones	Dates
(1)	Program Initiation	
(2)	First Successful Satellite Launch	
(3)	(U) Launch of First Block 5D-2 Satellite	20 December 1982
(4)	(U) Launch of Second Block 5D-2 Satellite	17 November 1983
(5)	(U) Award of Multiyear Procurement contracts	FY 1983
(6)	(U) Development of Shuttle/Titan II Qualified Primary Sensor	FY 1982-85
(7)	(U) Development of Titan II Qualified Spacecraft	FY 1985-90
(8)	(U) First Launch from Titan II	FY 1990
(9)	(U) Shared facility at Thule operational	1Q FY 1988
(10)	(U) Command/control facility at Fairchild AFB operational	1Q FY 1988
(11)	(U) Close existing Loring AFB command facility	1Q FY 1989
(12)	(U) Development of Shuttle optimized DMSP II	FY 1988-94

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35171F
DOD Mission Area: #410 - Space Launch & Orbital Support

Title: Space Launch Support
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		34,880	93,835	79,232	116,978	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Department of Defense places heavy reliance on its space assets to accomplish its missions. Requirements include such capabilities as communications, navigation, weather, early warning, and surveillance. An access to space is required for these space assets to perform their respective missions. The Space Launch Support Program provides the Space Transportation System resources needed to place Air Force space payloads in their mission orbits. The program objective is to provide consolidated management, programming, and execution of Air Force Space Shuttle, Inertial Upper Stage (IUS), Centaur G Upper Stage, and Payload Assist Module-Delta Class II (PAM-D II) activities for Air Force research and development and operational satellite programs. Work performed in support of research and development satellite programs is funded in the RDT&E appropriation; work performed in support of operational satellite programs is funded in the O&M appropriation.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	34,180	93,835	115,975		Continuing	N/A
Missile Procurement	108,490	208,039	329,808		Continuing	N/A

EXPLANATION: (U) The decrease in FY 86 RDT&E funding reflects a mission model change that requires less funding for Orbiter Flight Charges. The decrease in FY 1985 missile procurement funding reflects a decrease in IUS advance buy due to a lower unit cost for IUS vehicles. The decrease in FY 1986 missile procurement funding reflects a change in upper stage requirements: A planned buy of five IUS Upper Stages in FY 85-87 has been reduced to a buy of three in FY 85-86.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement						
Funds	108,442	187,939	295,999	211,407	Continuing	N/A
Quantities (Order/Full Fund)						
Inertial Upper Stage		(3/0)	(0/3)		0	17 vehicles
Payload Assist Module - Delta Class II	(0/1)	(0/6)	(0/9)	(16/8)	Continuing	N/A
Centaur Upper Stage				(4/0)	Continuing	N/A
Other Procurement						
Funds		5,005	3,236	3,134		
Quantity		N/A	N/A	N/A		
Operations and Maintenance	325,818	531,965	662,546	990,991	Continuing	N/A

5. (U) RELATED ACTIVITIES: The IUS development, Department of Defense Space Shuttle operations capability development, and the acquisition of the Vandenberg Air Force Base Shuttle launch site are being accomplished in the STS Acquisition Program, PE 64411F and PE 12449F. The research and development satellite programs supported include the Space Test Program, PE 63402F, and the first five Space Shuttle missions of the Milstar Satellite Communications Program, PE 33603F. Resources are provided in the outyears to support other systems in conceptual development. The operational satellite programs supported are the Defense Satellite Communications System, PE 33110F; the Defense Support Program, 12431F; the Nuclear Detonation Detection System (also known as IONDS), PE 12433F; the Navstar Global Positioning System (GPS), PE 35165F; the Satellite Data System, PE 35158F; and the Milstar Satellite Communications Program, PE 33603F. The individual Air Force payload programs will provide resources for nonrecurring integration and program unique launch hardware and/or services. The resources for support to other Department of Defense programs are included in the appropriate Special Activity and Department of the Navy Program Elements.

6. (U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Space Division, Los Angeles Air Force Station, CA. Systems engineering is provided by the Aerospace Corporation, El Segundo, CA. The IUS and spacecraft integration contractor is the Boeing Aerospace Company, Seattle, WA. The Centaur contractor is General Dynamics/Convair Division, San Diego, CA. The PAM-D II contractor is the McDonnell-Douglas Astronautics Company, Huntington Beach, CA. The payload integration contractor is Martin Marietta Corporation, Denver, CO. The Vandenberg Air Force Base Shuttle processing contractor (SPC) is the Lockheed Space Operations Company, Titusville,

FL. National Aeronautics and Space Administration is the Space Transportation System manager and operates the national Space Shuttle eastern launch site at Kennedy Space Center, FL, and the Mission Control Center at Johnson Space Center, TX.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 35171F, Space Launch Support

A. (U) Project Description: This program provides the Shuttle launch support resources common to the Department of the Air Force research and development and operational satellite programs. This support includes procurement of the IUS, Centaur G, and PAM-D II upper stages, their associated launch services, payment of Orbiter Flight Charge (OFC) reimbursements to the National Aeronautics and Space Administration, provision of mission control operations, recurring payload integration, the Manned Space Flight Engineer (MSE) Program, and operation of the national Space Shuttle launch site at Vandenberg AFB, CA.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Production and fabrication of IUS vehicles under the first production contract continued. The Shuttle processing contractor began effort to transition from the activation contractor at the Vandenberg AFB Space Shuttle launch site. Payload integration and flight operations planning activities for USAF payloads continued. The PAM-D II upper stage block buy contract to support GPS was awarded. Efforts continued to develop and implement the Manned Spaceflight Engineer (MSE) program which enhances Shuttle mission operations through the use of man during on-orbit operations. The MSE program provides payload specialists who will fly on selected Air Force missions.

(2) (U) FY 1985 Program: The FY 1985 program will include payment of the OFC and integration costs to support an RDT&E mission to be flown in FY 1986. All IUS vehicles under the first production contract will be delivered in FY 1985. Centaur G upper stage procurement to support the Milstar program will begin. Six PAM-D II upper stages to support the GPS program will be delivered. The MSE program will continue with payload specialist selection and training for DOD Shuttle missions. The components for the first Space Shuttle mission at the Vandenberg Launch and Landing Site (VLS), Orbiter 103 (Discovery), the external tank, and the solid rocket boosters will be assembled and processed.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: The FY 1986 program will include payment of secondary payload Shuttle flight charges to NASA. Secondary payloads include experiments, small payloads, and tests performed in the Shuttle crew cabin. Production will continue for the Centaur upper stage started in FY 1985 for Milstar. Production will begin for a second Centaur upper stage for the Milstar program.

FY 1986 funding will also sustain the MSE program. The first DOD Vandenberg Space Shuttle mission will be launched. This is the first of two DOD missions at VLS that will be conducted by the Shuttle processing contractor under management of the Air Force. The IUS and Orbiter Flight Charge cost estimates are based upon firm prices from the contractors and NASA. Cost estimates for the MSE program and for Centaur procurement were derived from contractor estimates and prior experience for similar efforts. Cost estimates for the PAM-D II vehicles are based on the approved multi-year procurement profile.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones:

		Milestones		Dates
(1)	(U)	IUS DSARC II		March 1978
(2)	(U)	Long lead award, 1st IUS production contract		July 1980
(3)	(U)	First Shuttle Flight		April 1981
(4)	(U)	First DOD use of the Shuttle		June 1982
(5)	(U)	First Titan/IUS flight		October 1982
(6)	(U)	Shuttle Initial Operational Capability (IOC) at Kennedy*		November 1982
(7)	(U)	First Shuttle/IUS flight**		April 1983
(8)	(U)	Shuttle Processing Contract Award		October 1983
(9)	(U)	PAM-D II block buy contract		December 1983
(10)	(U)	First DOD operational Shuttle flight	(4th Qtr FY 1984)***	January 1985
(11)	(U)	Shuttle IOC at Vandenberg AFB		October 1985

* NASA Milestone
** Civil payload
*** Date presented in FY 1985 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES:

(10) (U) Inertial Upper Stage problems delayed the launch until December 1984. Problems with the thermal protection tiles on Orbiter 99 delayed the launch one more month.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #71112F
DOD Mission Area: #475 - Central Supply and Maintenance

Title: Inventory Control Point Operations
Budget Activity: #6 - Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	1,000	4,034	5,361	14,031	24,426
3090	Embedded Computer Support Improvement Program	0	1,000	4,034	5,361	14,031	24,426

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Embedded Computer Software Improvement Program (ESIP) is a program to improve the support of embedded computer systems (ECS) through technical innovations, applied management techniques and information distribution. This program involves four areas: (1) Automation and Standardization of ECS Support Processes, (2) Extendable Avionic Integration Support Facility (EAISF), (3) ECS Readiness Support, (4) ECS Support Networks.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	1,371	14,274		38,731	54,376

FY 1986 and follow-on funding was reduced by transfer of project 3026 (Logistics Command, Control, Communications and Intelligence) from this program element to PE 78031F, (Logistic C3I).

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Related activities are in: 63728F, Advanced Computer Technology; 63266F, Ada Programming Language; 63752F, Software Engineering Institute; 64201F, Advanced Avionics Standardization; and 64740F, Computer Resource Management Technology. The related activities are directed at the development of new support tools and systems which are easier to support. This project is the only effort which directly improves existing ECS support capabilities.

6. (U) WORK PERFORMED BY: Competitive contracts managed by Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, Ohio.

(U) Project: 3090, Embedded Computer Support Improvement Program

A. (U) Project Description: see para 2.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable

(2) (U) FY 1985 Program: Requirements definition of the Extendable Avionics Integrated Support Facility (EAISF). Development of a rapid reprogramming workbench for Electronic Counter-Countermeasures (ECCM) software.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Development and demonstration of prototype EAISF. Study rapid radar ECCM reprogramming system architecture and determine ECCM parametric data. Investigate requirements for tailoring the EAISF to specific weapons systems. Cost estimates were derived by assigning resource requirements to a task breakout based on program office experience and meetings with potential vendors. The estimates are preliminary.

(4) (U) Program to Completion: Weapon system specific design and development of an EAISF (Advanced Tactical Fighter is a likely candidate). Development of an integrated reprogramming capability for radar ECCM software.

C. (U) Major Milestones:

Milestones	Dates
(1) (U) EAISF Requirement Definition Started	September 1985
(2) (U) EAISF Requirement Final Report	July 1986
(3) (U) Technology Demonstrator Prototype Start	July 1986
(4) (U) Phase 1 Demo of Technology Developed	July 1988
(5) (U) Phase 2 Demo of Technology Developed	July 1990

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #72207F
DOD Mission Area: #475, Central Supply and Maintenance

Title: Depot Maintenance
Budget Activity: #6, Defense-wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM EL_MENT		0	0	489	4,895	Continuing	N/A
3217	High Accuracy Milimeter Wave Calibration Support	0	0	459	0	0	459
3218	Phase Angle Standard	0	0	30	0	0	30
3219	Microwave/Millimeter Wave Metrology	0	0	0	1,735	Continuing	N/A
3220	Electro-Optical Metrology	0	0	0	1,365	Continuing	N/A
3221	Electrical/Electronic Metrology	0	0	0	545	Continuing	N/A
3222	Physical/Mechanical Metrology	0	0	0	450	Continuing	N/A
3223	Automated Test Equipment/Systems Metrology	0	0	0	800	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The US Air Force Metrology and Calibration Program (AFMETCALP) develops, procures, and distributes measurement standards and associated equipment to some 130 Base Precision Measurement Equipment Laboratories (PMELs) which are strategically located around the world. These standards are used in the calibration of every weapon system in the AF inventory, and must provide accuracies which are traceable to the National Bureau of Standards (NBS). These accuracies are the foundation for the calibrations necessary to place aircraft, bombs, and missiles on target in times of aggression. Inherent in the technology of modern weapons systems is also the requirement for research and development of the calibration standards to support them. The equipment necessary to accomplish this task is not available. This FY 1986 new start will provide the means to accomplish this vital task within a timely manner.

Program Element: #72207F
DOD Mission Area: #475, Central Supply and Maintenance

Title: Depot Maintenance
Budget Activity: #6, Defense-wide Mission Support

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement (In various program elements)						
Funds	11,718	13,119	57,252	59,642	Continuing	Not Applicable
Quantities	116	122	130	130		

5. (U) RELATED ACTIVITIES: Not Applicable

6. (U) WORK PERFORMED BY: Research and development of calibration standards is accomplished primarily by the National Bureau of Standards in cooperation/collaboration with the Engineering Working Groups (EWG) of the Calibration Coordination Group (CCG) of the Joint Technical Coordinating Group for Metrology and Calibration (JTCG-METCAL). The JTCG-METCAL is a Tri-Service group under charter of the Joint Logistics Commanders. Minor portions of this tasking are accomplished within the Air Force Measurement Standards Laboratory by colleges, universities, and/or industry contractors.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. (U) Project: 3217, High Accuracy Milimeter Wave Calibration Support. This project will establish national standards and measurement services where there are none, as well as establishing a capability for rapid, multifrequency, automated measurements at the Air Force Measurement Standards Laboratories. Equipment to be developed will consist of a dual, six-port automatic network analyzer system and a calorimeter to support the measurement parameters of power, attenuation, and impedance; and three separate standards for thermal noise, antenna, and phase noise measurements. All of these standards will support the Military Strategic-Tactical and Relay (Milstar) satellite system which requires downlinking and crosslinking in the 40 to 60 gigahertz range. The Air Force Metrology and Calibration Program has had very little money to invest in the research and development of this project to date. In FY 1982 and FY 1983, $10 and $33 thousand, respectively, were directed towards this project. In FY 1984/1985, no funds were available for this project and although some funds have been directed to this project in the past, the FY 1986 requirement is, essentially, a new start.

Program Element: #72207F

DOD Mission Area: #475, Central Supply and Maintenance

Title: Depot Maintenance

Budget Activity: #6, Defense-wide Mission Support

B. (U) Project: 3218, Phase Angle Standard. Development of a Phase Angle Standard is required to replace the Standard that is currently in the Air Force Precision Measurement Equipment Laboratories which is nearly 20 years old. That Phase Standard is of the 1950's technology, employing vacuum tube type construction. Currently, industry does not make a microprocessor-based phase standard that can replace the old unit; therefore, the National Bureau of Standards has been called upon to develop a standard in conjunction with the collaboration of the Engineering Subgroups of the Calibration Coordinating Group. Although this project is nearly finished, FY 1986 is the first year research and development funds have been made available for this project and may be construed to be a new start.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #78011F
DOD Mission Area: #490 - Production Base Support

Title: Industrial Preparedness
Budget Activity: #6 - Defense Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		49,005	56,000	104,540	117,847	Continuing	N/A
2865	Manufacturing Technology	49,005	56,000	104,540	117,847	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program which consists of four interrelated efforts: (1) Industrial Facilities which maintains, rehabilitates, and modernizes/improves Air Force owned, contractor operated facilities and equipment at 14 Air Force owned and 120 contractor owned plants; (2) Industrial Base Planning which performs analyses of the industrial base and develops plans to correct deficiencies/gaps, to reduce acquisition costs and leadtimes, and to improve overall industrial capability; (3) Manufacturing Technology (MANTECH) which demonstrates advanced manufacturing techniques to reduce product and depot maintenance costs and leadtimes and improve product quality, includes the Manufacturing Science thrust; and (4) Industrial Productivity and Responsiveness Improvement which accomplishes industrial base Technology Modernization (Tech Mod) and industrial preparedness measures. The FY 1986-1990 Defense Guidance required actions be taken to improve efficiency and productivity in the peacetime defense industrial base, improve responsiveness and our ability to surge, mobilize, and sustain wartime production, and increase efforts in industrial base planning. The RDT&E funded MANTECH portion of the Program Element emphasizes peacetime productivity improvements.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

RDT&E	49,005	61,859	71,120	Continuing	N/A
Aircraft Procurement	129,500	78,500	75,500	Continuing	N/A
Missile Procurement	25,695	31,400	30,442	Continuing	N/A
Other Procurement	2,094	2,495	2,490	Continuing	N/A

In the RDT&E appropriation, the FY 1985 difference was a Congressional reduction without prejudice. For FY 1986 the Defense Resources Board as well as the Air Force added funding to more closely align the program with current Defense Guidance. In Aircraft Procurement, the FY 1985 difference represents a Congressional reduction of funds for environmental restoration and transfer to a centrally managed Department of Defense (DoD) account. The FY 1986 difference was an addition of funds to enhance Production Surge capability. In Missile Procurement, the FY 1985

difference was also the transfer of environmental restoration funds to DoD. The FY 1986 difference resulted from a reduction in the Advanced Medium Range Air to Air Missile (AMRAAM) Technology Modernization Program and a reduction in funding for Air Force Plants. In Other Procurement, the FY 1986 difference is an addition of funding for projects to enhance Production Surge capability.

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement:						
Funds	129,510	67,500	89,200	99,200	Continuing	N/A
Quantities	N/A	N/A	N/A	N/A	N/A	N/A
Missile Procurement:						
Funds	29,572	25,400	12,926	33,208	Continuing	N/A
Quantities	N/A	N/A	N/A	N/A	N/A	N/A
Other Procurement:						
Funds	2,074	2,495	14,326	7,302	Continuing	N/A
Quantities	N/A	N/A	N/A	N/A	N/A	N/A

5. (U) RELATED ACTIVITIES: Both the Army and Navy maintain active Industrial Preparedness programs (PE 78011A and PE 78011N) which are coordinated with this program as appropriate. Other government agencies such as the National Aeronautics and Space Administration and the National Bureau of Standards maintain active MANTECH related efforts. The three service MANTECH programs as well as other government efforts are fully coordinated through the Department of Defense Manufacturing Technology Advisory Group (MTAG) which includes both government and industry participation. Technology base programs help provide the research and development which MANTECH then scales-up, integrates, validates demonstrates and establishes as new or improved production capability. MANTECH provides production technologies for implementation by the Technology Modernization (TECHMOD) Program/Industrial Modernization Incentives Program (IMIP). This program element supports nearly all Air Force hardware acquisition and in-house production and maintenance.

6. (U) WORK PERFORMED BY: The program is executed by Air Force Systems Command and Air Force Logistics Command for implementation primarily by private industry and in Air Force Air Logistics Centers (ALCs). Agencies participating include the Wright Aeronautical Laboratories, Wright-Patterson AFB; OH; AFSC Product Divisions, and the ALCs. Technical effort is accomplished almost exclusively by contract and nearly all major aerospace prime contractors and many sub-tier vendor contractors participate. The top five major contractors are General Electric Company, Evendale, OH; Battelle Memorial Institute, Columbus OH; United Technologies Corporation, West Palm Beach, FL; Hughes Aircraft Company Fullerton CA; and Systems Research Laboratories, Dayton, OH.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 2865, Manufacturing Technology

A. (U) Project Description: The Manufacturing Technology (MANTECH) program is a broad based production improvement program that provides new/innovative manufacturing technologies which result in more economical, timely, and reliable production of Air Force systems. Projects result in factory floor application of productivity enhancing improvements. The program is needed to significantly improve the productivity of our industrial base and thus reduce Air Force life-cycle costs. To do this, the MANTECH program fosters the use of enhanced manufacturing equipment, processes, and techniques, and continuously advances the state-of-the-art in manufacturing by bridging the gap from R&D to production. MANTECH helps stimulate industrial innovation by reducing the costs and the risks of advancing and applying improved production methods and equipment. Major current thrusts include: 1) Airframe Production and Productivity, 2) Low Observable Configurations Manufacturing and Production, 3) Propulsion Systems Production and Productivity, 4) Electronics Integration and Assembly, 5) Air Force Logistics Command Maintenance and Repair Productivity, 6) Parts-on-Demand/ Computer Integrated Manufacturing, 7) Strategic Missile and Launch System Production, 8) Space System Manufacturing and Production, 9) Tactical Systems Manufacturing and Production, and 10) Manufacturing Science.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Developed plan to respond to Congressional direction to fund entire MANTECH program in the RDT&E appropriation. Completed separately funded Integrated Computer Aided Manufacturing Program and began implementation of the technologies and techniques through a manufacturing center concept. Developed automatic tester for Very Large Scale Integrated (VLSI) Circuits. Completed detailed design of Integrated Sheet Metal Fabrication Center. Completed work in scaling up a high temperature processing technique for radar absorbing materials and structures. Successfully demonstrated X-ray inspection technique for rocket motor inspection of tactical and strategic missiles.

(2) (U) FY 1985 Program: Establish optimum metalworking techniques to scale-up production of billet, plate and sheet materials made from high strength powder aluminum alloys. Track the benefits from inflight experience with superplastic formed/diffusion bonded titanium structure. Establish automated processes for fabrication of advanced fighter engine vane and frame structures from organic composites. Demonstrate high temperature isothermal rolling mill for difficult to process alloys. Establish processing methods to improve radiation hardness for integrated circuits. Establish second generation automatic deriveter for use in removing fasteners from aircraft under repair. Implement neutron radiography in inspection of aluminum honeycomb structure for corrosion. Demonstrate assembly, test, and inspection methods for improved reliability thermal battery production for advanced tactical missiles. Develop methods to enhance the production yield of Mecury-Cadmium-Telluride detector arrays.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: In the Airframe Production and Productivity thrusts, methods and processes will be established to provide advanced materials in precursor form and establish techniques to fabricate, shape, and assemble economical, high quality, composite and metallic aircraft structures. The thrust includes continued in-service benefits tracking, formation of a forging/foundry industry data base, and establishment of an automated cell for superplastic forming technology demonstrated in previous MANTECH investments. In the Low Observables thrust, a more efficient process will be established for the manufacture of low radar signature radomes. In the Propulsion System thrust, efforts will continue in development of low cost manufacturing processes for organic composite structures for turbine engines, and casting methods will be established for high density, high strength alloys for turbine airfoils. In the Electronic Integration and Assembly thrust, methods will be established for reliable screening of high-complexity VLSI chips and methods will established to control processing and achieve higher yields in the manufacture of Galium Arsenide wafers for electronic circuits. For AFLC Maintenance and Repair Productivity, composite repair technology will be demonstrated at the Air Logistics Centers, an engine repair center will be established and will include automated removal of blades and automated monitoring of chemical solutions, a robotically controlled paint stripper will be installed, computer geometric modelling techniques will be applied to the automatic inspection of turbine blades, and detailed design and preliminary prototypes will be prepared for an Electronics Repair Center. In the Parts-on-Demand/Computer Integrated Manufacturing thrust, an Advanced Machining System will be established to integrate computerized scheduling and control with automated machining, a machining vendor initiative will be started to tailor the latest machining technologies to smaller companies, hardware and software will be implemented in an Integrated Composites Fabrication Center, benefits tracking will be initiated on a number of MANTECH projects, a Manufacturing Technology Information System will be continued and upgraded, and previous Integrated Computer Aided Manufacturing (ICAM) and robotics projects will be applied to the demonstration of Intelligent Automated Assembly of aircraft components. In the Strategic Missile thrust, new, low cost manufacturing processes for carbon fiber components will be transitioned to production. In the Space Systems thrust, earlier radiation hardening technologies will be optimized for new chip-set designs. In the Tactical Systems thrust, demonstration of processing, packaging, and testing of millimeter wave diodes will be initiated and production techniques will established and tested for the bonding of new transparent materials for Chemical Protective Masks. In the Manufacturing Science thrust, off-line computer simulation and actual demonstration of autoclave curing of composites will be accomplished and an Institute for Artificial Intelligence in Manufacturing will be initiated.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM
TITLE: INDUSTRIAL PREPAREDNESS

PROGRAM ELEMENT 78011F

DOD Mission Area: #480 - Production Base Support
Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
AIRCRAFT PROCUREMENT, AIR FORCE							
A AA01	Large Aircraft Fuselage Mfg. C-17, ATB, future large A/C	3178	4400	2100	1500	0	11766
A AA02	Large Aircraft Wing Mfg. B-1B, C-17, ATB	900	1500	2100	600	0	5400
A AA03	Mfg. Process Effects on Properties All A/C Systems	131	150	150	150	319	900
A AA04	Mfg. Methods for Thermoplastics ATF	0	0	900	1000	200	2100
A AB01	Foundry/Forging Industry Base All Systems	0	0	5500	6500	6500	18500
A AB02	Superplastic Formed Aluminum ATF, JVX, Future Systems	0	0	1000	1500	1000	3500
A AC01	Radome Mfg. Process Applications Classified	0	0	1000	2000	500	3500
A AD01	Mfg. Tech for Adv. Propulsion Materials JFE	0	2000	13800	13700	12600	42100
A AD02	Vader Process JFE	0	0	900	1000	0	1900
A AE01	TWT Factory Integration All Airborne ECM Systems	0	0	6000	7000	2000	15000
A AG01	Advanced Machining Systems F-16, ATF	6535	0	2300	0	0	10500
A AG02	Machining Vendor Initiative F-16, B-1B, ATF	0	2500	3500	1700	700	8400

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM

PROGRAM ELEMENT 78011F
TITLE: INDUSTRIAL PREPAREDNESS

DOD Mission Area: #480 - Production Base Support
Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
AIRCRAFT PROCUREMENT, AIR FORCE						
A AG03 Integrated Composites Center F-16, F-15, F-18, AV-8B, ATF	0	3000	3000	4000	1000	11000
A AG04 Integrated Data Base Management All Systems	0	1600	3500	3000	1500	9600
A AG05 Intelligent Task Automation *Jointly funded with DARPA F-15, Electronic Assemblies	0	2000 (1500)*	3500 (2400)*	0 (2550)*	0	5500 (6450)*
A AG07 Assembly Automation Integration ATF	0	0	2900	5000	15000	22900
A AG08 Communications Technology for Vendors/Subcontractors All Systems	0	0	4000	4000	4000	12000
A AG09 Solid State Microwave System ATF Radar	0	1000	5800	6000	9600	22400
TOTAL AIRCRAFT PROCUREMENT, AIR FORCE, RELATED	N/A	N/A	61,950	N/A	N/A	N/A

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM
TITLE: INDUSTRIAL PREPAREDNESS

PROGRAM ELEMENT 78011F
DOD Mission Area: #480 - Production Base Support
Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
MISSLE PROCUREMENT, AIR FORCE							
A MA01	SICBM Propulsion Manufacturing Midgetman	0	0	1000	1500	750	3250
A MA02	SICBM Components	0	0	2000	2000	750	4750
A MB01	Mercury/Cadmium/Telluride(MCT) Detectors Surveillance Systems	0	0	900	2000	600	3500
A MB02	Radiation Hardening Chip Set MILSTAR	0	500	800	1000	6000	2900
A MB03	Millimeter Wave IMPATT Diodes Communication Satellites Tactical Missile Seekers	543	0	408	189	0	1140
A MC01	Seeker Assembly/Integration Tactical Missiles	0	0	600	600	0	1200
TOTAL MISSILE PROCUREMENT, AIR FORCE, RELATED		N/A	N/A	5,708	N/A	N/A	N/A

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM
TITLE: INDUSTRIAL PREPAREDNESS

PROGRAM ELEMENT 78011F
DOD Mission Area: #480 - Production Base Support
Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
OTHER PROCUREMENT, AIR FORCE						
A 0A01 Integrated Electronics Factory All Items, Systems	0	500	4000	6000	14000	24500
A 0B01 Protective Mask Assembly MCU-2P Mask	0	0	500	600	0	1100
TOTAL OTHER PROCUREMENT, AIR FORCE, RELATED	N/A	N/A	4500	N/A	N/A	N/A

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM
TITLE: INDUSTRIAL PREPAREDNESS

PROGRAM ELEMENT 78011F

DOD Mission Area: #480 - Production Base Support
Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
O&M, AIR FORCE							
A LA01	Composite Repair Center Depot Maintenance of F-16, F-15, ATF	0	0	2500	3100	400	6000
A LB01	Engine Repair Center Depot Maintenance of F-100, F-101, TF30, J79	0	450	5250	2000	0	7700
A LC01	Robotic Application/Paint Stripping F-16, F-4, F-111 Repair F-100 Engine Repair	0	2800	2950	2000	600	8350
A LG01	Geometric Modelling Engine Depot Maintenance	0	1500	2000	2000	0	5500
A LG02	Electronics Repair Center Depot Maintenance of all Systems	0	50	2000	2000	1950	6000
A LG03	Integrated Blade Inspection System Engine Depot Maintenance	0	0	1500	0	0	1500
A LG04	Logisitics Product Support Tech. Depot Spares Acquisition	0	0	4000	7000	2500	13500
TOTAL O&M, AIR FORCE, RELATED		N/A	N/A	20,200	N/A	N/A	N/A

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM
TITLE: INDUSTRIAL PREPAREDNESS

PROGRAM ELEMENT 78011F
DOD Mission Area: #480 - Production Base Support
Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)		FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
GENERIC PROCUREMENT, AIR FORCE							
A GA01	In-Service Benefits Tracking	25	50	50	50	Cont.	N/A
A GB01	VLSI Technology All VLSI Applications	0	6200	7500	7700	3400	24800
A GC01	Manufacturing Cost/Design Guide All Systems	0	350	700	700	0	1750
A GD01	Manufacturing Technology Benefits Analysis	250	500	700	700	800	2950
A GD02	Manufacturing Tech. Management Information System	873	450	200	200	Cont.	N/A
A GD03	Manufacturing Technology Program Assessment	0	0	150	250	300	700
TOTAL GENERIC AIR FORCE PROCUREMENT RELATED		N/A	N/A	9300	N/A	N/A	N/A

FY 1986 MANUFACTURING TECHNOLOGY PROGRAM

TITLE: INDUSTRIAL PREPAREDNESS

PROGRAM ELEMENT 78011F

DOD Mission Area: #480 - Production Base Support

Budget Activity: #6 - Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) I.D. (End Items Supported)	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Complete	Total Est Cost
R & D, AIR FORCE						
A RA01 Smart Assembly Generic Applicability	443	1101	356	0	0	1900
A RB01 CAE System for Die Design & Mfg. Generic Applicability	1000	1100	1100	550	0	4300
A RC01 Enhanced Yield of MCT Detector Generic Applicability	825	1000	1400	245	0	3470
A RD01 Computer-aided Curing of Composites Generic Airframe & Missile Applicability	870	1325	825	225	1155	4600
A RE01 Institute of Artificial Intelligence in Mfg. Generic Applicability	0	500	1500	1500	4000	7500
TOTAL R & D, AIR FORCE, RELATED	N/A	N/A	5181	N/A	N/A	N/A

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: 78026F
DOD Mission Area: 480 - Production Base Support

Title: Productivity, Reliability, Availability, and Maintainability (PRAM) Program
Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		12,646	13,865	17,365	21,512	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force has an urgent need to reduce the rising cost of ownership and improve productivity, reliability, availability, and maintainability of its operational systems. The Office of the Secretary of Defense (OSD) FY 1981-1985 Consolidated Guidance stated, "We have learned that it is virtually impossible to anticipate and solve all reliability problems in a complex weapon system before it is fielded. In order to realize the intended performance from a system, one must plan to improve the design with reliability and maintainability modifications throughout most of its service life." PRAM has continued to respond forcefully to fill this major gap for programs, since its inception by the Air Force Chief of Staff in 1975, through judicious and timely investments in projects leading to lower life cycle costs and improved operational readiness. The need for continuing this vital program has been documented over the years by commanders of both Air Force Systems Command and Logistics Command, and has been underscored by the Assistant Secretary of Air Force for Research, Development and Logistics as well as the Under Secretary of Defense for Research and Engineering.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	12,646	14,865	19,747		Continuing	N/A

Program funding decreased in FY 1985 and 1986 as a result of Congressional action.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: This program is related to Program Element (PE) 64212F, Aircraft Equipment Development (AED), which has as one of its goals the reduction of weapon systems ownership costs through development of aircraft equipment with minimum life cycle cost. The PRAM and AED programs complement each other. AED basically funds development of end item equipment. PRAM primarily funds adaptation of: high reliability, current technology to older systems; commercial items and procedures to military specifications; and improvements in development and acquisition techniques, methods and specifications.

PRAM also plays a complementary role with the Aircraft Engine Component Improvement Program (CIP), PE 64268F. The CIP is concerned with supportability performance factors and reliability growth in specific current operational engines. PRAM's role deals with those efforts applicable to engines to improve reliability or lower engine life cycle costs. To ensure their complementary operation, PRAM propulsion projects are closely coordinated with the Air Force Propulsion Lab and the Aeronautical Systems Division's Propulsion Program Office. A dialogue has been established with the Army and Navy through which program activities and accomplishments are exchanged.

6. (U) WORK PERFORMED BY: The PRAM Program Office is located at Wright-Patterson AFB, OH. Satellite PRAM offices have been established at each of the five Air Force Air Logistics Centers and at the Aerospace Guidance and Metrology Center in Newark, OH. The Air Force Flight Dynamics, Avionics, Materials and Propulsion Laboratories, as well as the Air Force Flight Test Center, Aeronautical Systems Division, and the Space Division, have been participants in PRAM projects. The ten largest PRAM contractors are: Emerson Electric Company, St Louis, MO; Varian Associates, Incorporated, Palo Alto, CA; National Cash Register, Dayton, OH; Mitre Corporation, Lexington, MA; Denison University, Granville, OH; Hughes Aircraft Company, Van Nuys, CA; General Electric Company, Burlington, VT; Hydraulic Research Division of Textron, Incorporated, Valencia, CA; the Garrett Corporation, Phoenix, AZ; and Micromega, Bunker-Ramo Corporation, Westlake Village, CA.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986: Not Applicable.

8. (U) SINGLE PROJECT OVER $10 MILLION IN FY 1986:

(U) Project: 78026F, Productivity, Reliability, Availability, and Maintainability (PRAM).

A. (U) Project Description: The Department of Defense (DOD) Consolidated Guidance for FY 1981-1985 states "our tactical Air Forces represent the most expensive investment among our general purpose forces. Procurement and operating costs continue to rise steadily; more rapidly than defense spending as a whole, even after adjusting for inflation." The guidance further expresses "deep concern about the future impact of these trends on the size, age, and readiness of the forces," and calls for "major initiatives to reverse these disturbing trends and to provide an effective combat capability commensurate with our increasing commitment of resources." The PRAM program is filling this urgent requirement to reduce the rising cost of ownership while improving the operational readiness of our in-service weapon systems. PRAM investments lead to lower life cycle costs. These improvement projects drive the very same parameters (e.g., productivity, reliability, availability, and maintainability) that also improve operational readiness. As of 30 Sep 84, PRAM has initiated 692 projects representing a cumulative PRAM investment of $92 million with an estimated program net savings, five years after implementation, of $2.8 billion. These projects were in the areas of airframes, avionics, propulsion, missiles and space, depot maintenance, and other support areas.

The average cost of a PRAM project is $400 thousand. In FY 1984, PRAM managed approximately 128 separate contractors involved in some 190 active projects. This program attacks the high cost of doing business by focusing management attention and funds in a concentrated effort to reduce operational and support costs without sacrificing systems effectiveness. The program objectives are pursued through investments in cost reduction projects. These projects are to: improve the reliability and maintainability of weapon systems through modifications and part substitution; improve the efficiency and productivity of maintenance and logistics support organizations at all levels through improved procedures and documentation; exploit lower life cycle cost alternatives in systems configurations through component commonality methods and techniques; and enhance the operational readiness of our deployed systems. Implementation of these projects leads to: reduced support manpower requirements; lower spares consumption, stock levels and storage/transportation costs; improved force readiness; and fuel conservation through improved equipment and techniques. The need for PRAM projects for operational systems stems from the fact that technology advances through several cycles during the single lifetime of many of our systems. Successful prototypes or studies are not implemented directly by PRAM, but through procedural changes of the Air Force Modification Program.

To manage this program, an office has been established which is manned by personnel experienced in the research and development, acquisition, and logistic support disciplines. This is a joint Logistics Command and Systems Command office equally responsible and responsive to the two commanders. As such, the program office is able to cut across traditional, functional and organizational lines to accomplish its goals. This office provides an integrating leadership function, achieving its objectives primarily through interaction with Air Force Laboratories, System Program Offices, Air Logistics Centers, Major Commands and industry.

PRAM provides the front-end risk reduction, investigation, prototyping and evaluation of improvement projects geared toward in-service weapon systems. PRAM projects lead to improved hardware, specifications, standards, test methods, and adaptation of commercially available items to lower in-service weapon system/subsystem life cycle costs. PRAM projects are subject to audit during the amortization period to verify savings. Typical five yesr savings are about 5 to 1, including implementation costs.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: The $12.6 million program provided a stable program funding level. In the functional areas addressed by PRAM (i.e., airframes, avionics, missiles and space, propulsion, depot and other support), advances in technology have accelerated through several generations of the operational life span of most of our older weapon systems without transition. PRAM continued to harness much of this new technology and facilitate its transition to our in-service systems to lower the cost of ownership. In addition, PRAM continued to place great emphasis on support of urgent Air Force initiatives within its charter. In this regard, PRAM has undertaken projects

to increase reliability, increase productivity, conserve fuel, and reduce operations and support costs. One project to increase reliability replaced the amplifier in the B-52 and C-130 autopilots. The old amplifier was of dated mid-50s technology, had extremely poor reliability, and was becoming unsupportable. The PRAM effort prototyped a form-fit-function solid-state replacement with a tenfold reliability increase. Five year savings for this effort are expected to exceed $110 million. An effort to improve depot productivity evaluated removing paint from aircraft with plastic particles to allow corrosion control and repainting. In addition to cutting painting preparation time to less than half in comparison with current methods, the plastic particle method greatly reduces the environmental hazard of toxic chemical paint strippers. Conservative estimates show a five year savings potential of $10 million.

(2) (U) FY 1985 Program: FY 1985 will maintain the necessary level of participation of different Air Force agencies in the exploitation of cost reduction opportunities. Senior military and civilian Air Force executives continue to stress the need for this vital program. Accordingly, PRAM will apply maximum management attention to improve the operational readiness and to lower the cost of ownership of our older in-service systems. Some examples of projects programmed for FY 1985 include a KC-135 Compass System Reliability improvement, an improved APQ-122 Radar Indicator Group that uses a digital scan converter to reduce current level of system failures, evaluation of Environmental Stress Screening of parts in systems with known high failure rates to improve the reliability, and Thermoplastic Injection Molding for manufacturing aluminum or titanium components. The estimated five year savings for these example projects alone is $49.27 million at an initial cost of $1.6 million. Candidate PRAM projects exceeding the budget request have been compiled. As in the past, projects actually pursued will be those offering the best potential return on investment.

(3) (U) FY 1986 Planned Program and Basis for 1986 RDT&E Request: The FY 1986 program will continue to provide investment funds for projects leading to reduced cost of ownership or enhanced force readiness in the areas of airframes, avionics, propulsion (non-Component Improvement Program applications affecting logistics support, repair technology and test methods that impact more than one engine model), missiles, depot maintenance and other support areas. Specific projects to be funded will be formulated by the PRAM Program Office and its affiliated field offices. Selection of projects will be based on such criteria as risk, projected cost, return on investment, net savings, amortization period, implementation period, or the contribution to current Air Force initiatives (i.e. readiness, mobility, fuel conservation) within the scope of the PRAM charter. Projects selected for investment will continue to be audited during the amortization period.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable.

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 78031F
DOD Mission Area: #475 - Central Supply and Maintenance

Title: Logistics C^3I
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	100*	9,933	9,944	Continuing	N/A
3157	Log C^3I	0	100*	9,933	9,944	Continuing	N/A

*Funds in PE 63106F

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will satisfy the Air Force Logistic Command (AFLC) requirement for an automated Command, Control, Communication, and Intelligence (C^3I) system which will provide operational and logistics commanders critical information on readiness, sustainability of the force and the capability to predict and assess logistics supportability. This system will be interfaced to the World-Wide Military Command and Control (WWMCCS) Information System and will provide essential resource information to battlefield commanders. This program will be initiated in FY 1985 under an existing Program Element, PE 63106F (Logistics Research and Development Requirements). Program Element 78031F is a new start in FY 1986.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	0	0	2,130	12,293	Continuing	N/A
Quantities	Not Applicable.					

5. (U) RELATED ACTIVITIES: Not Applicable.

6. (U) WORK PERFORMED BY: The Logistics (LOG) C^3I system will be developed by Electronic Systems Division (Air Force Systems Command), Hanscom AFB, MA. Mitre Corp., Bedford, MA, will provide technical support. Additional contractors for the design and development are to be determined.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3157, LOG C^3I

A. (U) Project Description: The Logistics Command, Control and Communications and Intelligence (LOG C^3I) System will provide Air Force Logistics Command (AFLC) Commanders a means to interface with the warfighting components. The program will provide critical mission support in the following areas:

(1) Assessment and Prediction. The LOG C^3I System will enhance predictive logistics assessments of present and future priority requirements in terms of the rationale employed in developing war plans and exercise scenarios. It will identify limiting factors and present alternative solutions.

(2) Force Multiplier. If critical parts and war consumables which are most likely to ground or restrict aircraft operation are identified and pre-positioned or redistributed expeditiously under a LOG C^3I system, an effective increase in sortie rate can be realized. This increased sortie generation capability can be stated in equivalent terms of additional weapon systems to achieve the required level of combat capability.

(3) Sustainability. Sustainability is the staying power of our forces, units, weapon systems and equipment often measured in number of days of combat effectiveness. The LOG C^3I capability focuses on the weapon systems and equipment aspects of sustainability. Through the LOG C^3I system more accurate and timely logistics decisions can be made with regard to stockage, repair actions and redistribution, with consequent increase in combat effectiveness.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable.

(2) (U) FY 1985 Program: An architecture of the LOG C^3I system will be accomplished in FY 85. The functional description will be finalized and a Request For Proposal (RFP) will be formulated for the Phase I system.

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Key tasks include definition of system scope, system engineering and integration. A RFP will be released and a contract awarded for the system design and development of Phase I of the system. Phase I includes selected system modules of the overall system. Phase II, the final phase, includes interfacing the Air Logistics Centers and other logistics organizations into the system. Hardware/software will be developed to interface the LOG C^3I system to the WWMCCS Information System. The cost estimate for the FY 1986 President's Budget (PB) was accomplished by making a comparison to similar systems and analyzing such cost factor as general system engineering, program support, unique software and hardware development and catalog prices for off-the-shelf Automatic Data Processing Equipment (ADPE).

(4) (U) Program to Completion: Preliminary and critical design reviews for software and hardware will be conducted. The Phase I system will be acquired and installed. Remaining hardware, software, and communications (Phase II) will be designed, developed, acquired, and installed. System performance and acceptance tests will be conducted.

C. (U) Major Milestones:

	Milestones	Dates
(1)	(U) Functional Description	FY 1985
(2)	(U) Request For Proposal Formulation	4Q FY 1985
(3)	(U) Request For Proposal Release	1Q FY 1986
(4)	(U) Contract Award	2Q FY 1986

8. (U) PROJECTS OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #91212F — Title: Service-Wide Support
DOD Mission Area: #477 - Administration and Associated Activities — Budget Activity: #6 - Defense wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	196	490	Continuing	N/A
3117	Air Force Computer Security Program	0	0	196	490	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element covers those activities which occur across major command and program boundaries, including "standard" information services and supporting activities such as computer security. The RDT&E funds in this element are for the Computer Security Program Office (CSPO), and represent its contribution to the work of the Computer Security R&D Coordinating Committee. This funding supports management-oriented aspects of computer security R&D, including risk analysis, protection of unclassified but sensitive or proprietary data, and similar efforts.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable

5. (U) RELATED ACTIVITIES: Not Applicable

6. (U) WORK PERFORMED BY: The Air Force Computer Security Program Office, Gunter Air Force Station, Alabama, in conjunction with Air Force Systems Command, will be the in-house developing organization responsible for the program. No contractors are currently associated with the program.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION IN FY 1986:

(U) Project: 3117, AF Computer Security Program

A. (U) Project Description: This is a new start. Data Project Directive (DPD) HAF-P81-001, "Air Force Automated Data Processing Security Project", tasks the Air Force Computer Security Program Office (AFCSPO) to provide an adequate level of security for all sensitive or critical AF computer resources, while ensuring that security costs are commensurate with the value of the resources to be protected. The AFCSPO seeks to remedy deficiencies in risk analysis,

security specifications for computer system acquisition, and protective mechanisms for hardware and software through vigorous participation in development or acquisition of advanced technology computer security products through AFSC. Recent progress in artificial intelligence technology appears to be the most likely research area to provide solutions to problems in information aggregation protection, authentication, and system penetration technology.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable

(2) (U) FY 1985 Program: Not Applicable

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Investigate the application of threat modeling to an automated risk analysis system. Analyze and define requirements for a system to collect, maintain, and simulate computer security threat data against AF embedded computer resources (command, control, communications, and intelligence systems, weapon systems, space systems, etc.) and data processing, support, and communications facilities. This capability will enable system managers and developers to develop cost effective security management programs. Cost estimates are estimates based on Program Office past experience (Category IV - Planning level) as of 14 November 1984.

(4) (U) Program to Completion: Continue threat modeling systems work. Develop and apply current artificial intelligence technology to solve problems associated with (1) determining the classification of related and aggregated information which is unclassified individually; (2) authenticating would-be users of a computer system; and (3) providing automated penetration analysis support for testing and certification of secure and trusted computer systems.

C. (U) Major Milestones:

		Milestones	Dates
(1)	(U)	Develop feasibility study for threat modeling	3rd Quarter FY1986
(2)	(U)	Evaluate threat modeling technology	4th Quarter FY1986
(3)	(U)	Begin artificial intelligence project requirement development	1st Quarter FY1987
(4)	(U)	Complete threat modeling prototype	4th Quarter FY1987
(5)	(U)	Artificial intelligence prototype development and evaluation	1st Quarter FY1988

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #91215F
DOD Mission Area: #490 - Production Base Support

Title: Productivity Investments
Budget Activity: #6 - Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		0	0	978	979	Continuing	N/A
3169	Productivity Enhancement	0	0	978	979	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: FY 86 New Start. Improve mission readiness through the selective financing of productivity enhancing capital investments (PECI). Reduce operating cost (labor and/or materials) of various functions by the substitution of technology for inefficient procedures and methods. Expand current PECI programs to include RDT&E funded activities. Currently, RDT&E funded activities are excluded from participation in the Fast Payback Capital Investment (FASCAP) Program and the Component Sponsored Investment Program (CSIP) due to lack of Appn 3600 funds. Effective FY 86, $1.0M was transferred from Appn 3080 to Appn 3600 to permit RDT&E funded activities to benefit from PECI funding. Projects under $100K which amortize investment costs within two years are funded under FASCAP, other projects which take up to five years to amortize or cost over $100K are funded under CSIP. These two programs have an average life cycle return on investment of over $8 for every $1 invested.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: Not Applicable

4. (U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
Other Procurement:						
Funds	14,479	14,534	3,271*	1,429*	Continuing	N/A
Quantities	N/A					
Military Construction:						
Funds	2,000	0	0	0	Continuing	N/A
Operation & Maintenance:						
Funds	990	4,339	14,124*	13,121*	Continuing	N/A

* Realignment of funding between operating and procurement appropriations to reflect proposed revision to expense and investment criteria.

5. (U) RELATED ACTIVITIES: This project parallels the Productivity Enhancement (PE 91215F) programs available to non-RDT&E funded activities.

6. (U) WORK PERFORMED BY: Air Force Systems Command and HQ Air Force will manage this program. AFSC activities will implement the various projects.

7. (U) SINGLE PROJECT LESS THAN $10 MILLION:

(U) Project: 3169 - Productivity Enhancement

A. (U) Project Description: See paragraph 2.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1984 Accomplishments: Not Applicable

(2) (U) FY 1985 Program: Not Applicable

(3) (U) FY 1986 Planned Program and Basis for FY 1986 RDT&E Request: Improve mission readiness through the selective financing of productivity enhancing capital investments (PECI). Reduce operating cost (labor and/or materials) of various functions by the substitution of technology for inefficient procedures and methods. Expand current PECI programs to include RDT&E funded activities. Currently, RDT&E funded activities are excluded from participation in the Fast Payback Capital Investment (FASCAP) Program and the Component Sponsored Investment Program (CSIP) due to lack of Appn 3600 funds. Effective FY 86, $1.0M was transferred from Appn 3080 to Appn 3600 to permit RDT&E funded activities to benefit from PECI funding. Projects under $100K which amortize investment costs within two years are funded under FASCAP, other projects which take up to five years to amortize or cost over $100K are funded under CSIP. These two programs have an average life cycle return on investment of over $8 for every $1 invested. Cost estimate is Category IV, Planning, based on FASCAP/CSIP usage at non-RDT&E activities and availability of FASCAP/CSIP funds Air Force-wide.

(4) (U) Program to Completion: This is a continuing program.

C. (U) Major Milestones: Not Applicable

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable

FY 1986 RDT&E DESCRIPTIVE SUMMARY

Program Element: #01004F
DOD Mission Area: #460, International Cooperative RDT&E

Title: International Activities
Budget Activity: #6, Defense-Wide Mission Support

1. (U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate	FY 1987 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2,857	2,842	2,894	3,044	Continuing	N/A
2446	von Karman Institute	325	350	375	375	Continuing	N/A
2447	SHAPE Technical Centre/ AGARD/Coop R&D	2,532	2,492	2,519	2,669	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program satisfies Department of Defense (DOD) administrative agent responsibilities for the North Atlantic Treaty Organization (NATO) Advisory Group for Aerospace Research and Development (AGARD) in Paris, France and for the Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) in The Hague, Netherlands; pays for United States scientists at STC; supports United States Air Force participatio in cooperative research and development (R&D) agencies and groups; and pays the United States' share of NATO support for the von Karman Institute in Brussels, Belgium. Support of this program is a continuing international commitment under the auspices of NATO and our mutual weapons development agreements with our allies.

3. (U) COMPARISON WITH FY 1985 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1984	FY 1985	FY 1986	FY 1987	Additional to Completion	Total Estimated Cost
RDT&E	2,722	2,842	2,908		Continuing	N/A

EXPLANATION: (U) Civilian Pay salary adjustments.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: Supports international cooperative R&D agreements, Information Exchange Projects, the US Mutual Weapons Development Data Exchange Program, The Technology Cooperation Program with the United Kingdom, Canada, Australia, and New Zealand, the Defense Research Group, and the US Air Senior National Representative to the Under Secretary of Defense for Research and Engineering. Also supports USAF participation in NATO Armaments research, development and acquisition initiatives including representation on groups and subgroups under the NATO Conference of National Armaments Directors and the NATO Air Force Armaments Group.

6. (U) WORK PERFORMED BY: Several hundred leading US civilian and military scientists, engineers, and administrators.

7. (U) PROJECTS LESS THAN $10 MILLION IN FY 1986:

A. Project: 2446, von Karman Institute. Funds US share of NATO support to the von Karman Institute for Fluid Dynamics in Brussels, Belgium. This international research facility is instrumental in advancing the state-of-the-art in fluid dynamics and related disciplines. The von Karman Institute was founded in 1956 under NATO auspices as an international, non-profit, scientific organization. Principal objectives--provide post-grad programs in fluid dynamics aeronautics, turbomachinery. Financial support comes from the supporting nations (57%), Belgian national support (13%) and research grants or industrial contracts (30%). US share of the 57% internationally-funded portion is 12.5%, for cooperative basic research with other NATO nations. US von Karman Institute Fellowships support up to five US participants annually. The Institute graduated over 70 internationally trained scientists, conducted ten lecture series attended by 400 NATO scientists/engineers, and published numerous technical reports. Five United States participants were supported by fellowships. Continuing the US contribution will provide a flow of internationally educated scientists who return this expertise to their own countries. A program of cooperation between the von Karman Institute and the Air Force Institute of Technology (AFIT) will be initiated.

B. Project: 2447, SHAPE Technical Centre/AGARD/Coop R&D. The Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) is a multinational organization responsible directly to the Supreme Allied Commander, Europe. The Centre provides scientific and technical advice on military problems with emphasis on Command, Control and Communications. The United States Air Force (USAF), as administrative agent, supports 21 of 114 international scientist and engineer positons at STC. The North Atlantic Treaty Organization (NATO) reimburses these salary expenses, at NATO rates, through credits to our NATO account. The Advisory Group for Aerospace Research and Development (AGARD) provides technical advice and assistance to the NATO Military Committee, promotes advances and cooperation in aerospace sciences and provides assistance to requesting NATO member nations to help increase their aerospace scientific and technical potential. The USAF is also administrative agent for AGARD and funds non-government as well as USAF participation in the AGARD scientific and technical meetings. This includes contracting for special services such as language translation for meetings in the US. In addition to AGARD-sponsored cooperative Research & Development (R&D) efforts, this program pays for USAF participation in data exchange and engineer exchange agreements with free world countries, and participation in those NATO agencies and groups in which USAF membership and participation is directed by treaty or other agreement. During FY 1984 Memoranda of Understanding (MOU) for three NATO armaments initiatives were negotiated: Short Range Anti-Radiation Missile (SRARM), Long Range Stand-Off Missile (LRSOM) and Low Cost Powered Dispenser (LOCPOD). The LRSOM MOU was signed. STC initiated nine new projects and continued work on 17 other projects in Force Capability Studies and International level Command, Control and Communications for the Allied Command Europe. AGARD conducted 17 symposia, 11 lecture series, 104 consultant missions and published 74 documents. An MOU on Low Altitude Dispensers and a Data Exchange Agreement (DEA) on Biodynamics were signed with Germany. A Master DEA was negotiated and an MOU signed with Brazil on a Scientist/Engineer Exchange Program. An MOU on Millimeter Wave Technology was

signed and an Information Exchange Program on Low Frequency/Very Low Frequency Transmission Systems concluded with the UK. Planning and Review Pricing Data on E-3A Airborne Warning and Control System (AWACS) was provided to France. Continue to support cooperative RDT&E with our allies and to implement Secretary Weinberger's Emerging Technologies initiatives. The following Memorandums of Understanding (MOUs) and Data Exchange Agreements (DEAs) are scheduled to be negotiated in FY 1985: fuse testing with Israel, mid-atmospheric testing with Norway, Development/Evaluation of Advanced Resonators/Oscillators with France, Airfield Attack with Germany and Scientist/Engineer Exchange Programs with the United Kingdom, Australia, Norway and France. Continue funding the salaries of 21 US Scientists/Engineers and administrative personnel assigned to SHAPE Technical Center (STC) who work on Electronic Warfare and Command and Control Systems. Support participation of up to 100 US experts in Advisory Group for Aerospace Research and Development (AGARD) technical panels and working groups. Support AGARD meetings in the US to include French/English interpr[illegible]ion. Also continue to support international cooperative RDT&E initiatives under the NATO Conference of National Armament Directors, to meet US treaty obligations through participation in NATO working groups and conferences, and continue the Scientist and Engineer Exchange Program with NATO and non-NATO nations. STC is the primary source of scientific advice on military matters to the Supreme Allied Commander, Europe. US scientists and engineers are assigned to STC for three-year tours to provide US expertise and influence. Upon return, their NATO experience is transferred to the US R&D community. AGARD promotes cooperative R&D thru information exchange under the aegis of the NATO Military Committee.

8. (U) PROJECT OVER $10 MILLION IN FY 1986: Not Applicable.

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES

FUNDED BY RDT&E

Department/Agency: Air Force

Date: December 1984

PART 1. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY

Specialized R&D facilities determined to be necessary for the performance of a contract for a Military Department for research and development, may be constructed by or furnished to the contractor and funded from appropriations available for research, development, test and evaluation. The Congress enacted this legislation, now 10 USC 2353, in 1956. This policy is executed through DOD Directive 4275.5. Under this policy, the Secretaries of the Military Departments or their designees, and the Directors of Defense Agencies may approve facilities projects up to $3,000,000; the Under Secretary of Defense Research and Engineering approves projects exceeding $3,000,000. The Congress is notified in advance of starting any project involving construction, regardless of the dollar amount. The table below provides a summary of all such projects accomplished in FY 84 and planned in FY 85 and FY 86.

Facility/Equipment	RDT&E Project Number	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1984	1985	1986	1987
SECTION I							
Projects Accomplished or Underway							
Rapid Runway Recovery Facility	64617F	In-house	Europe	2,055.0	1,107.0		
CONUS OTH-B Radar	12417F	General Electric	Maine: Bingham (Transmit Fac.) Columbia Fallks AFS (Receive Fac.) Bangor IAP (Ops. Center)	4,000.0			
Advanced Visual Technology System (AVIS) Equipment Installation	63227F	General Electric	Williams AFB AZ	727.6			
Install LANTIRN Simulator	63227F	Singer Inc.	Williams AFB AZ	185.0			
ESD - Bldg 13020 Addn to Elec Research Lab 1/	63250F	MIT - Lincoln Lab	Hanscom AFB MA	978.4			

Facility/Equipment	RDT&E Project Number	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1984	1985	1986	1987
SECTION II							
Projects Planned or Projected							
ESD - Bldg 1302J Addn to Elec Research Lab 2/	63250F	MIT - Lincoln Lab	Hanscom AFB MA		2,300.0		
ESD - Extension to L-Band Transmitter High-Bay Area 1/	12424F	MIT - Lincoln Lab	Hanscom AFB MA		332.0		
ESD - Bldg 1302C Addn to Elec Research Lab 1/	63250F	MIT - Lincoln Lab	Hanscom AFB MA		2,221.8		
TOTAL PART 1				7,946.0	5,960.8		

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MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E

PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED/GOVERNMENT-OPERATED INSTALLATIONS

Chapter 251 of the DOD Budget Manual (which was approved by the GAO as DOD Instruction 7220.5) provides that RDT&E appropriations may finance the development, design purchase and installation (including directly related foundations, shielding, environmental control, weather protection, structural adjustments, utilities and access) of equipment or instrumentation required for research, development, test and evaluation activities. Facilities which are consumed in R&D test and evaluation, prototype facilities/equipment, and temporary facilities are also financed as part of the R&D appropriation involved since their intended utility expires when a test is completed. (Note: Contractor-operated facilities are included in Part 1.) The table below provides a summary listing of all such projects for the installation of equipment, where the cost of installation is more than $200,000, accomplished in FY 84 and planned in FY 85, FY 86, FY 87.

Facility/Equipment	RDT&E Program Element Number	Location	Total Obligational Authority (Thousands of Dollars) 1984	1985	1986	1987
		SECTION I				
		Projects Accomplished or Underway				
		A. Equipment Installation				
Machinery Condition Monitoring 1/	65807F	AEDC, Arnold AFS, TN	62.7	271.3		
Improve 16S Test Instrumentation Improvement 1/*	65807F	AEDC, Arnold AFS, TN	62.1			
CAD CAM 1/*	65807F	AEDC, Arnold AFS, TN	400.0			
TAC Implementation 1/*	65807F	AEDC, Arnold AFS, TN	225.0	265.0	275.0	340.0
Test Facility Plant Automation 1/*	65807F	AEDC, Arnold AFS, TN	388.0	298.0	424.0	292.0
WIS-Development and Evaluation Facility 1/	33152	Hanscom AFB, MA	1,400.0		1,190.0	
Modernize Component Research Air Facility 1/	62203F	WPAFB OH, Bldgs 18B, 18C, 18E	2220.0	1520.0	150.0	500.0

Part 2. (cont'd)

Facility/Equipment	RDT&E Program Element Number	Location	1984	Total Obligational Authority (Thousands of Dollars) 1985	1986	1987
		SECTION I (cont'd)				
		B. Test				
Canister Assembly Launch Test Program 1/	64312F	Nevada Test Cite, Nevada	300.0	300.0	100.0	- 0 -
Modify Gasdynamics Facility 1/	62201F	Wright-Patterson AFB, Ohio	325.0			
		C. Prototype - None				
		D. Temporary				
Temporary Liquid Hydrogen Supply System 1/	62302F	Edwards AFB, CA	370.0			

Part 2. (cont'd)

Facility/Equipment	RDT&E Program Element Number	Location	Total Obligational Aut... (Thousands of Dollars) 1984	1985	1986	1987

SECTION II

Projects Planned or Projected

A. Equipment Installation

Facility/Equipment	RDT&E Program Element Number	Location	1984	1985	1986	1987
Test Preparation Lab, VKF 1/	65807F	AEDC, Arnold AFS TN		131.6	148.5	
AEDC Cells C-1 & C-2 Vector/ Reverse Thrust 2/	64755F	AEDC, Arnold AFS TN		7.0	290.0	
Facility Computer & Network Improvement 2/	65807F	AEDC, Arnold AFS TN		171.1	103.7	85.2
ETF Facility Computer Upgrade 2/	65807F	AEDC, Arnold AFS TN			60.0	40.0
C-1 Joint Technology Demonstrator Engine 2/	64755F	AEDC, Arnold AFS TN			349.0	
Upgrade Arc Heater 2/	64755F	AEDC, Arnold AFS TN				100.0
ETF-B Rocket Exhaust Mod 1/	65807F	AEDC, Arnold AFS TN				564.0
Tempest/RF Shielding (1633) 1/*	11121F	Edwards AFB CA	43.1			
Tempest/RF Shielding SYS ENG TEST (1260) 1/*	63258F	Edwards AFB CA		44.1		
Tempest/RF Shielding (1250) 1/	27130F	Edwards AFB CA	50.0			

Part 2. (cont'd)

Facility/Equipment	RDT&E Program Element Number	Location	Total Obligational Authority (Thousands of Dollars) 1984	1985	1986	1987

SECTION II (cont'd)

A. Equipment Installation (cont'd)

Facility/Equipment	RDT&E Program Element Number	Location	1984	1985	1986	1987
AFSTC/OL-AA, Malabar FL Malabar Advanced Telescope System 2/	64710F	MALABAR TEST ANNEX (ESMC) Malabar FL			55.0	
Electromagnetic Shielding for Payloads 1/	64411F	Vandenberg AFB CA		2,000.0		
Test Facility Space Transportation System 1/	64411F	Vandenberg AFB CA		5,700.0	4,900.0	
Top Secret Computer Facility 2/	65806F	Wright-Patterson AFB OH		440.0		
Install Combustion Air Heaters, Exhaust System & Controls 1/	62203F	Wright-Patterson AFB OH Bldg 490		685.0		
Replace Test Cell Augmentor 1/	62203F	Wright-Patterson AFB OH Bldg 71A, B-Day			200.0	
Install Fuel System Simulator 2/	62203F	Wright-Patterson AFB OH Bldg 490, Rm 144			300.0	
Install Computer Systems Support 1/*	62204F	Wright-Patterson AFB OH		400.0	185.0	
Locate/Construct Temporary Site for Airborne Imagery Transmission (ABIT) 1/	63727F	Wright-Patterson AFB OH		50.0	200.0	
Upgrade Battery/Fuel Cell Laboratory 2/	62203F	Wright-Patterson AFB OH Bldg 18			300.0	

Part 2. (cont'd)

Facility/Equipment	RDT&E Program Element Number	Location	1984	1985	1986	1987
			Total Obligational Authority (Thousands of Dollars)			
		SECTION II (cont'd)				
		B. Test				
**Peacekeeper Basing Mod Testing 1/	64312F	Nevada Test Cite, Vandenberg, Edwards, and other CONUS	176,200.0	213,000.0	149,600.0	98,100.0
		C. Prototype				
Unattended Short Range Radar Station North Warning System 1/*	12412	FOX - 1AA, NWT, Canada FOX - CAA, NWT, Canada		11,300.0		
		D. Temporary - None				
Total Part 2			182,045.9	236,583.1	150,530.2	100,021.2

* Approved cost or scope change
** Includes test for Deep Basing and Hard Launcher programs and small missile testing.
1/ Listed in previous submittal
2/ Initial submittal

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES

FUNDED BY RDT&E

PART 3. UTILIZATION OF RDT&E APPROPRIATION FOR MINOR CONSTRUCTION

For in-house installations, construction projects in support of R&D for $200,000 or less are funded from RDT&E appropriations. Such expenditures are authorized by 10 USC 2805 and the applicable provisions of the current DOD Appropriation Act. Under this procedure, project approval at this level is authorized by the Major Command concerned, or delegated to R&D installation commanders as appropriate. The table below provides a summary total of such minor construction accomplished in FY 84, and the estimated amounts planned for FY 85 and FY 86. All minor construction must result in a complete and usable facility. In no event are two or more minor construction projects or minor and major construction projects to be contrived to form a usable facility:

SUMMARY OF MINOR CONSTRUCTION FUNDED BY RDT&E, AIR FORCE

	FY 84	FY 85	FY 86	FY 87
TOTAL PART 3	6,471.1	22,287.8	7,052.5	5,954.4
RECAP OF FUNDING				
SUBTOTAL PART 1	7,946.0	5,960.8		
SUBTOTAL PART 2	182,045.9	236,583.1	158,830.2	100,021.2
SUBTOTAL PART 3	6,471.1	22,312.8	7,052.5	5,954.4
GRAND TOTAL	196,463.0	264,856.7	165,882.7	105,975.6

MINOR CONSTRUCTION PROJECTS (EEIC 529)
FUNDED IN RDT&E

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
SD, Vandenberg AFB CA	12449F	VAB 84-0110	1559	Construct Satellite Supply Bldg	147.2			
SD, Vandenberg AFB CA	12449F	Various	Multi	Miscellaneous (2 projects)	14.9			
SD, Vandenberg AFB CA	12449F	VAB 84-0098	836	Enlarge Overhead Doors	41.0			
SD, Vandenberg AFB CA	12449F	VAB 84-0105		Site Preparation, 9 Meter Telemetery Antenna	155.6			
SD, Vandenberg AFB CA	12449F	VAB 84-0106	1786	Alterations for Computer Installation	18.0			
SD, Vandenberg AFB CA	12449F	Various	Multi	Various GSCRs	22.7			
SD, Vandenberg AFB CA	12449F	VAB 85-0137		Tracking and Data Relay Support		60.0		
SD, Vandenberg AFB CA	12449F	VAB 83-0111	5500	STS Central Supply Facility		160.0		
NASA, Kennedy Space Center FL	12449F	NASA #1	.	Construct Classified Material Destruct Facility	190.0			
NASA, Kennedy Space Center FL	12449F	NASA #2	Multi	Security Modifications, Huntsville Operations Support Center	190.0			
Edwards AFB CA Relocate Avionics Radar Labs, F-15 MSIP	27130F	800537	1020	Provides for a Mechanical Equipment Area and a Radar Antenna Structure to Support Avionics Systems Testing for the F-15 MSIP	76.0			
ASD, Wright-Patterson AFB OH	27133F	WP 324-4	12	Support Systems Furniture	28.2			

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Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
ESD/*GWEN TLCC (Thin Line Connectivity Capability, Relay Nodes)	33131F	ES-84-01-48	95 Sites CONUS	Site Work, Concrete Pads and Power		12,500.0		
ESD/WS3 (Weapon Storage and Security System)	35155F	ES-85-007	Eglin AFB FL	Installation of Test Vault		80.0		
ESD/WIS Development and Evaluation Facility (DEF)	33157F	ES-83-013B WIS-C-0332 HA-84-0106C	1302F Annex Hanscom AFB	Interior Modifications/Exterior Electrical	156.0			
ESD/ECAC (Electromagnetic Combatibility Analysis Center)	33144F	ES-83-046	Annapolis MD	SCI (Special Compartment Information Area)		49.0		
SD, Vandenberg AFB CA	36165F	VAB 84-0072	22104	Equipment Installation/Alter GPS Master Control Station	154.0			
AFWAL/ML, WPAFB	62102F	N/A	Various	5 projects each less than $15,000	25.3			
AFWAL/ML, WPAFB	62102F	Not Assigned	71A	Modification for Laser Equipment		120.0		
AFWAL/ML, WPAFB	62102F	Not Assigned	Various	9 projects each less than $15,000		70.0		
AFWAL/ML, WPAFB	62102F	Not Assigned	71A	Modification for laser equipment			80.0	
AFWAL/ML, WPAFB	62102F	Not Assigned	Various	10 projects each less than $15,000			80.0	
AFWAL/ML, WPAFB	62102F	Not Assigned	51	Modify Processing Facility				70.0
AFWAL/ML, WPAFB	62102F	Not Assigned	71A	Modification for laser equipment				50.0
AFWAL/ML, WPAFB	62102F	Not Assigned	Various	12 projects each less than $15,000				70.0

NOTE:
* Cost is lumped together because sites are to be determined (TDB). Sites include relay nodes, receive only, and input/output. Cost subject to change based upon system electronics, civil engineering design reviews, site locations, and construction contracting variables.

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
AFWAL/FI/WPAFB	62201F	N/A	20025C	Modify Gas Dynamics Facility	164.9			
AFWAL/FI/WPAFB	62201F	N/A	Various	Five (5) Projects	17.5			
AFWAL/FI/WPAFB	62201F	N/A	20065	Replace High Bay Louvers & Windows & Replace with Insulated Panels		50.0		
AFWAL/FI/WPAFB	62201F	N/A	20065	Add Fume Hood in Clean Rm., West Side		20.0		
AFWAL/FI/WPAFB	62201F	N/A	20065	40 x 100 ft. Roof Structure (Bone Yard)		50.0		
AFWAL/FI/WPAFB	62201F	N/A	20065	Steam Injection Systems, West Side		30.0		
AFWAL/FI/WPAFB	62201F	6-3-6029	20068	Insulate & Install Temperature Control		50.0		
AFWAL/FI/WPAFB	62201F	6-4-6024	20065	Paint All Concrete Surfaces		20.0		
AFWAL/FI/WPAFB	62201F	N/A	Various	Four (4) Projects		32.0		
AFWAL/FI/WPAFB	62201F	N/A	20024C	Modernize Restrooms		50.0		
AFWAL/FI/WPAFB	62201F	N/A	20024C	Wiring & Power Tunnel		20.0		
AFWAL/FI/WPAFB	62201F	N/A	Various	Two (2) Projects		25.0		
AFWAL/FI/WPAFB	62201F	N/A	20146	Floor-to-Ceiling Partitions		33.0		
AFWAL/FI/WPAFB	62201F	N/A	20146	Nine (9) Projects		37.0		
AFWAL/FI/WPAFB	62201F	N/A	20456	Weather Cover for M-6 Heater		15.0		
AFWAL/FI/WPAFB	62201F	N/A	20025C	Modifications Study		25.0		
AFWAL/FI/WPAFB	62201F	N/A	Various	Two (2) Projects		10.0		
AFWAL/FI/WPAFB	62201F	N/A	20045	SURVIAC Modification		85.0		
AFWAL/FI/WPAFB	62201F	N/A	20045	Six (6) Projects		33.5		
AFWAL/FI/WPAFB	62201F	N/A	20093	Modifications		30.0		
AFWAL/FI/WPAFB	62201F	N/A	30255	Construct Instrumentation Room		20.0		
AFWAL/FI/WPAFB	62201F	N/A	30255	Refurbish Office Space		18.0		
AFWAL/FI/WPAFB	62201F	N/A	20004F	Refurbish Office Space (SURVIAC)		70.0		
AFWAL/FI/WPAFB	62201F	N/A	Various	Two (2) Projects		14.0		
AFWAL/FI/WPAFB	62201F	N/A	Various	Two (2) Projects			17.0	
AFWAL/FI/WPAFB	62201F	N/A	ASRF	Oak Replacement, Range 3			50.0	
AFWAL/FI/WPAFB	62201F	N/A	ASRF	Winterization of Range 3			25.0	
AFWAL/FI/WPAFB	62201F	N/A	ASRF	CO2 Fire Protection Zone Control				25.0
AFWAL/FI/WPAFB	62201F	N/A	ASRF	Improved Airflow Capability				80.0
Brooks AFB	62202F	N/A	Multi	20 projects		70.0		
Brooks AFB	62202F	N/A	Multi	23 projects			75.0	
Brooks AFB	62202F	N/A	Multi	26 projects				80.0

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
Brooks AFB	62202F	CNBC 82-0045	125	Construct Projection Room		21.4		
Brooks AFB	62202F	CNBC 83-0051	820	Modify Restrooms & A/C	143.8			
AFAMRL, WPAFB	62202F	WP 386-4	29	Mod Basement for Lab		60.0		
		WP 326-6	79	Mod Ambient Lab		55.0		
		Not Assigned	838	Equip Installation MCP		118.0		
		Not Assigned	79	Mod Room 146 for Histology		15.0		
		WP 311-3	441	Construct SECRET Conference Room			60.0	
		Not Assigned	824	Equip Installation MCP			100.0	
		Not Assigned	33	Move SACDEF from Eastgate			100.0	
		Not Assigned	838	A/C to East Annex and Install Redundant A/C				190.0
AFAMRL, WPAFB	62202F	Not Assigned	Various	Misc. Projects				
				7 Projects	31.0			
				9 Projects		35.0		
				9 Projects			39.0	
				9 Projects				42.0
		WP 264-4	441	Mod Rooms	32.4			
		EQ 83-9111	79	Construct Necropsy Room	33.0*			
		Not Assigned	248	Install Intrusion Alarm	15.0			
		WP 353-4 & 354-4	441	C^3 Upgrade		34.0		
		WP 382-4	196	Upgrade		82.0		
Brooks AFB	62202F	N/A	Multi	19 projects	65.8			

NOTE:
* 100K funded in Fy 83 for total project cost of 133K.

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Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
AFWAL/PO/WPAFB	62203F	Not Assigned	20A	Install Test Chamber			20.0	
		Not Assigned	718	Install Chiller			100.0	
		Not Assigned	71	Modify Engine Stand for Battery Research			55.0	
		Not Assigned	490	Install Fuel System Simulator, Rm 144			50.0	
		Not Assigned	AFWAL/PO	18 Projects each less than $15,000				245.0
		Not Assigned	450	Modify Conference Rm, E-124				20.0
		Not Assigned	AFWAL/PO	9 Minor Construction Projects (each less than $15,000)	31.5			
		Not Assigned	18E	Modify Control Room 22	41.4			
		Not Assigned	18B	Install Monorails	21.3			
		Not Assigned	18G	Add to Thermal Energy Research Lab	30.0			
		Not Assigned	AFWAL/PO	17 Minor Construction Projects (each less than $15,000)		167.0		
		Not Assigned	450	Modify Offices to Research Areas		60.0		
		Not Assigned	18B	Install Soundproofing, Rm 16		65.0		
		Not Assigned	18	Modify Battery Laboratories		100.0		
		Not Assigned	AFWAL/PO	20 Minor Construction Projects (each less than $15,000)			230.0	
		Not Assigned	20	Modify Control Room			75.0	
AFWAL/AA/WPAFB	62204F	N/A	Various	15 projects each less than $15,000	44.3			
		WP-337-4	622	Alter for tech enhancement facility	143.0			
		WP-336-4	B21	Alter for expansion to observables facility	174.4			
		WP-338-4	Add to 620	Construct multi-purpose building	157.0			
		WP-335-4	620	Alter classified auditorium	23.9			
		N/A	Various	12 projects each less than $15,000		150.0		
		Not Identified	22	Alter for combat test facility (Companion to project EQ 86-9100)		150.0		
		Not Identified	4A/B	Alter for interface of hangars		100.0		
		Not Identified	18F	Alter for caliberation facility		40.0		
		Not Identified	22	Alter room 205 for classified work area		50.0		
		WP-358-4	22	Extension to AFWAL Tech Library		76.0		
		Not Identified	620	Alter MHU area for admin space		50.0		
		Not Identified	18F	Update wall mounted heating system		35.0		

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
AFWAL/AA/WPAFB	62204F	N/A	Various	12 projects each less than $15,000			150.0	
		Not Identified	22	Alter approx 10,000 SF for Eng			40.0	
		Not Identified	622	Alter for Shipping & Receiving Area			85.0	
		Not Identified	22B	Extend Chilled Water System in Labs			50.0	
		Not Identified	18F	Inst Fire Alarm & Sprinkler Sys in an area approx 21,100 SF			65.0	
		Not Identified	620	Const Stairway in Anechoic Chamber			20.0	
		Not Identified	Various	Unplanned, unidentified contingencies for small scale mission changes			50.0	565.0
AFRPL, Edwards AFB CA	62302F	840600	8424	Install 34.5 KV/480V Power Distribution		150.0		
		800607	8475	Propellant Laboratory Addition		190.0		
		820609	I-42 Complex	Install Work Shop		120.0		
		830605	I-52 Complex	Work Shop Addition		50.0		
		840604	I-32 Complex	Install Conditioned Metal Bldg on Pad 5B		35.0		
		840606	I-42 Complex	Dike Lox Storage Area		40.0		
		820606	I-40 Complex	Pave Access Road		90.0		
		Various	Multi	Miscellaneous (3 projects)		14.0		
		850602	8424	Install Concrete Supports, Interior Room, Exterior Shelter, Doorways, Windows		60.0		
Kirtland AFB NM	62601F	KLD-210-3	914	Security to R&D Vault	52.7			
			57001	HVAC/Elec System	79.0			
				Misc. Small Projects (2)	13.2			
			419	Security System, Intel. Vault		75.0		
			Various	Security Fencing		20.0		
			423	Upgrade Secure Conf. Room		40.0		
			Multi	Misc. Small Projects (4)		50.0		
			Multi	Misc. Projects (15)			200.0	
			Multi	Misc. Projects (15)				200.0

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
ASD, Wright-Patterson AFB	63005F	Not Assigned	16	Secu ity Modifications for ASD/YS		200.0		
Brooks AFB	63227F	N/A	Multi	2 projects	11.6			
		N/A	Multi	3 projects		14.0		
		N/A	Multi	5 projects			16.0	
		N/A	Multi	5 projects				16.0
		CNBC 84-0081	578	Construct Breakroom		57.5		
Williams AFB	63227F	Not Assigned	570	Port Task Trainer/Fabrication of R&D Equipment Shop		95.0		
		Not Assigned	558	Pump Room Conversion to Computer Area			95.0	
		Not Assigned	558/560/ 570	A/C Back Up System				195.0
ASD, Wright-Patterson AFB	64212F	Not Assigned	57	Renovate for Office Space		40.0		
		Not Assigned	57	Construct SECRET Conference Room		50.0		
	64226F	WP 380-3	52	AMS Installation	20.8			
	64231F	WP 373-4	[illegible]	Construct Secure Room for ASD/AF	31.3			
ASD, Wright-Patterson AFB	64326F	WP349-4	167	Construct Vault for ASD/YY	47.2			
Edwards AFB CA IMF Support for ACM	64361F	840533	369	Provides test table mounts security system and utility metering for the Integrated Maintenance Facility (IMF).	50.0			

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
SD, LAAFS CA	64406F	84-0044	115	Alter YN Vault	47.3			
ESD, Hanscom AFB MA AWDS (Automated Weather Data System)	64707F	ES-85-004	CONUS (TBD)	Modification to Bldg. Interior			110.0	
SD, LAAFS CA STC/OL-AA, Malabar FL	64710F	PA 36-5107A		Modify Telescope Structure			187.0	
ESD, Hanscom AFB MA CIS-ISS (Combat Identification System-Indirect Subsystem)	64725F	ES-85-006	Europe	Installation of Trailers		5.0		
ASD, Wright-Patterson AFB	64738F	WP 350-4	22	Construct Vault for ASD/YY	16.0			
		WP 331-1	28	Renovate Basement		50.0		
Edwards AFB CA Computer Room in Support of HH-60D	64753F	850531	1020	Provides a secure computer room with raised flooring, air conditioning and special power for the HH-60D computer system.	45.0			
ESD, Hanscom AFB MA	64770F	ES-86-005	CONUS	Modification to Bldg. Interior			200.0	
Brooks AFB TX	65806F	CNBC 84-0028	660	Const. Recreation Center	190.0			
		28908	437	Alter Base Supply	16.8			
		28665	718/719	Construct Handrails	17.5			
		29257	1070	Const. Sidewalk 5th St.-North Rd	28.0			
		29262	1070	Const. Sidewalk Main Gate-North Rd	31.3			
		29298	99000	Enlarge Pond	15.7			
		29264	99000	Upgrade Storm Drainage	81.0			
		CNBC 84-0058	704	Const. Military Clothing Sales Store		42.0		
		CNBC 84-0083	618	Install Emergency Generator, Bldg 618		25.0		
		CNBC 84-0024	1250	Electric Peak Monitor		45.0		
		CNBC 84-0019	1150	Construct Restroom		21.3		
		CNBC 84-0029	1200	Extend Gas Line		35.0		
		CNBC 84-0041	218-220	Alter Kitchenettes		52.0		

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
Brooks AFB	65806F	CNBC 85-0014	1250	Reroute Overhead Electric		100.0		
		CNBC 85-0025	1050	SAM Area Parking		35.0		
		CNBC 85-0029	Multi	Alter Restrooms for Handicapped		120.0		
		CNBC 85-0333	1050	Picnic Area Parking Lot		25.0		
		CNBC 81-0016	1260	Install Curb & Gutter			46.0	
		CNBC 85-0017	690	Smoke Training Fac.			25.0	
		CNBC 85-0026	99000	Watering System			80.0	
		CNBC 81-0035	185	Alter Drains in Animal Holding Area		40.0		
		CNBC 86-0023	1255	Upgrade Drainage			200.0	
		CNBC 87-0018	Multi	Parking Area Lights				30.0
		N/A	Multi	29 projects	116.9			
		N/A	Multi	30 projects		120.0		
		N/A	Multi	33 projects			130.0	
		N/A	Multi	36 projects				140.0
SD, Buckley ANGB CO	65806F	84-0001A1	Multi	Enlarge Perimeter Fence	100.0			
		84-0004	414	Construct Warehouse	90.0			
		85-0005	401	Modify Generator Room		50.0		
		85-0004		Expand Load Center K		180.0		
		85-0009		Construct Open Storage Yard		45.0		
		85-0011		Improve Ball Fields		30.0		
		86-0001	Multi	Expand Security Lighting and Sensor System			140.0	
		86-0002	Multi	Construct Perimeter Road			82.0	
		86-0003	Multi	Install Security Protection System			60.0	
		86-0006	401	Install Wainscot Interior Hallways			24.0	
		86-0007	412	Install Heating System			32.0	
SD, LAAFS CA	65806F	83-0044		Install Classroom Trailer	13.5			
		84-0034	403	Alter Graphics Center	90.0			
		83-0065	110	Renov B/110 2nd Floor MILSTAR		40.0		
		85-0039	Multi	Install A/C		40.0		
		84-0023A	73	Const Civil Eng Fac Ft Mac			108.0	
		84-0022	120	Air Cond OOM				45.0
		87-0030	Multi	Install Halon Fire Prot Sys				25.0

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	1985	1986	1987
ASD, WPAFB	65806F	WP 121-3	4A/4F	Renovate for Supply & EN	55.0			
		Multi	Multi	26 Minor Construction Projects	79.0			
		WP 175-4	167	Add to Bldg 167		200.0		
		WP 311-1	156	Renovate for ASD/EN		50.0		
		Not Assigned	11A	Construct Secret Conference Room		50.0		
		Not Assigned	7	Renovate Room 7 for PM		30.0		
		Multi	Multi	12 Minor Construction Projects		100.0		
		Multi	Multi	40 Minor Construction Projects			355.0	
		Multi	Multi	65 Minor Construction Projects				780.0
AEDC, Arnold AFS TN	65807F	800164	01075	Mark I Access Platform	18.1			
		800126	00795	PWT Valve 40A Line	138.5			
		840487	02302	Rpr ETF Lunch Room	17.0			
		810247	00451	Model Shop Acid Tank Cover	1.4			
		830498	00100	Super Computer	47.0			
		817009	01099	AEDC Power Contr Interface	14.9			
		820313	00100	Upgrade B Wing	13.0			
		810301	00579	APTU Valve Building	145.6			
		020103	00620	CAD/CAM Renovation	71.6			
		830451	00390	Alter FF&D PMEL	112.5			
		830434	00350	PMEL Bldg 350	188.9			
		830507	00100	Modify A&E Freight Elevator	40.0			
		830439	00111	Credentials Building	190.0			
		830488	60010	Perimeter Fence	136.3			
		830481	00785	16T Control Room Mod	139.8			
		800139	00879	Safe Handling ETF Rocket		115.1		
		830211	00676	Support Service Air Sys		72.0		
		840216	00678	Raceways/Trays G Range		133.0		
		790066	00445	Chem Lab Breezeway		44.3		
		800087	03039	Mod Pump Control System		31.2		
		800152	00785	Install 16T Cart Access		26.1		
		810035	00722	Install Heat HTL		89.0		
		810280	00445	CM Bldg Elect Syst		91.0		
		810291	60012	Parking Areas Basewide		200.0		
		830332	00760	Mod PWT M1 Building		16.0		

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
AEDC, Arnold AFS TN	65807F	830479	00718	Alter HTL Shop Bldg		175.0		
		830494	00899	Alter Bldg 899		200.0		
		840240	00890	Winterize J3 Work Area		36.3		
		840276	01478	Correct CE Bldg Fire Hazards		90.2		
		840498	00799	Construct FSD Maint Bldg		190.0		
		840502	10003	NCO Club Utilities		127.0		
		840534	00351	Inst Cathod Prot Wat Tanks		33.0		
		840289	00645	Modify MECO Bldg		121.3		
		840504	02215	Modify RPA # 2 Crane		181.0		
		860287	00879	L Cooler Design Mod			73.6	
		850397	00711	Add Raceways/Trays PWT			124.3	
		850254	01075	Vacuum Jacket Pipe MK1/LNZ			200.0	
		850261	02210	Mod J4 RPA Bldg 2210			92.9	
		830503	00520	Rpr J4/J5 Cont Rm & Area			61.3	
		830213	00225	Add to Bldg 225 - Dispensary			183.5	
		820329	01077	Mod 7V Clean Rm			28.8	
		830452	03017	Mod OOM Kitchen Exhaust			71.0	
		840497	00607	Prepare Laser Lab			115.5	
		810380	30002	Mod Steam Cond Return Lines			19.0	
		850303	00001	Const Ind Sys Paint Spray Booth			180.0	
		850342	03036	Upgrade Sewer Sys, Arnold Village			140.1	
		850349	20009	Install Elect Valves, Cool Water Sys			64.2	
		850356	01524	Install Nitrogen Sys - 161 KV Sys			129.0	
		850259	00878	Construct T3 Opns Ctrl Bldg			75.9	
		860260	01503	Install Var Speed Pumps - SPS			176.6	
		860285	30002	Repair Pipe Insulation FY 86			65.3	
		860274	01560	Install Rentent Pond Pump			35.0	
		840505	40002	Flow Metering GN2 Sys			56.9	
		860280	00878	Repair RIA Test Area			80.0	

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
AEDC, Arnold AFS TN	65807F	870237	00780	Add Raceways/Trays				132.8
		870213	01525	Enhance Ctrl Utility Sys				185.8
		870218	01553	Reroute Disc Line Stm Plnt				27.6
		870222	01508	Install CW Val Mon Ctrl				80.0
		870223	01553	Construct Addtl Pre Basin STP				100.5
		870225	01504	Relocate Cholor Rm WTP				23.0
		870229	00535	Install AR Light STP B				27.6
		870235	00745	Modify ADPE Security PWT				174.7
		870236	01077	Modify ADPE Security ELA				98.7
		860268	20009	Install Cooling Water Meters				55.2
		850309	00251	Install Emerg Response Sys				31.2
		850359	01091	Install Basin Covers/Htrs ASTF				123.2
		810273	00451	Modify Weld Outlets				170.6
		850261	02210	Addition J4 Bldg 221				92.9
		810284	01527	Flamm Storage Bldg				48.4
		840292	00320	Modify IVA Crane				47.4
		860250	00100	Construct Per Elev AE				89.1
		860263	03101	Install Mon/Ctrl/Sec Sys Dams				113.7
		860252	60010	Repair/Upgrade Rifle Range RD				150.0
Edwards AFB CA Construct Storage Yard	65807F	830523		Provides storage for highly classified strategic systems support equipment.	72.9			
Edwards AFB CA Addition to Bldg 1212	65807F	830531	1212	Provides an addition for various strategic systems programs utilizing the B-52 aircraft.	200.0			
Edwards AFB CA Widen Approach Pads 21 &22	65807F	820524	21/22	Provides a 50 foot wide concrete entrance to pads 21 thru 24		89.3		
Edwards AFB CA Construct Barrier Pits, South Base	65807F	790534	S. Base	Provides for barrier pits to protect barrier engines from rain and mud.		29.3		
Edwards AFB CA Alter Rm 2 of Base Ops for AWDS	65807F	860501	1200	Provides for the installation of the Automated Weather Distri. System			56.6	

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	1987
Eglin AFB FL	65807F	84-0137	100	Renovate for PAVE TACK	27.0			
		83-0415	18	Renovate Dining Hall	22.2			
		83-0389	1	Support Comm Scheme	35.2			
		84-0197	16	Renovate Conference Center	130.4			
		84-0083	130	Install 440 V Outlets	15.7			
		84-0215	N/A	Construct TAC Gatehouse	31.6			
		80-0234	N/A	Construct Picnic Areas	67.2			
		84-0147	36/38	Renovate Bldgs	28.3			
		84-0129	66	Renovate Bldg	32.2			
		83-0156	432	Renovate Bldg	40.5			
		79-0168	N/A	Propellent Processing Fac	124.6			
		84-0376	100	Upgrade 2nd Floor	17.1			
		83-0213	956	Construct Latrine	19.5			
		82-0067	N/A	Upgrade Power to Test Track	72.3			
		13 projects		Misc Small Under 15K	52.9			
		84-0054B	8100	Renovate NCO Beach Club		32.0		
		84-0138	N/A	Sewage Force Main		180.0		
		84-0421	N/A	Comm Scheme Support		34.0		
		82-0085	N/A	Install POL Off-Loading Arm		18.0		
		85-0078	920	Modify Bldg for Hydrazine		25.0		
		84-0400	410	Renovate Bldg		40.0		
		81-0224	505	Construct Addition		30.0		
		80-0335	134	Construct Addition		30.0		
		81-0401	N/A	Construct Fire Training Fac		80.0		
		84-0210A	10	Renovate Bldg		75.0		
		84-0209A	8	Renovate Bldg		75.0		
		7 projects		Misc Small Under 15K		56.0		
		84-0428	13	Construct Parking Lot			54.0	
		83-0244	2400	Addition to Fire Station			25.0	
		84-0323	N/A	Install Water Meters			36.0	
		84-0114	N/A	Install Water Line			88.0	
		80-0187	N/A	Install Seawall Site A-7			62.0	
		81-0124	791/799	Upgrade Electrical Service			20.0	
		84-0274	614	Modify Mezzanine			38.0	

Activity	Program Element	CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
Eglin AFB FL	65807F	83-0092	859	Modify Water Tank			126.0	
		82-0198	N/A	Construct POL Building			25.0	
		78-0127	17-20	Install Isolation Valves - Dorms			50.0	
		80-0173	976	Construct Addition			30.0	
		4 projects		Misc Small Under 15K			15.0	
		81-0190	300	Alter Facility				94.0
		81-0201	9566	Install Humidstat				20.0
		82-0133	955	Addition to Facility				200.0
		79-0096	N/A	Install Relay Protection				50.0
		83-0335	N/A	Install Water Softeners				99.0
		83-0336	N/A	Washrack and Equipment Shelter				25.0
		84-0332	N/A	Expand BX Parking Lot				47.0
		4 projects		Misc Small Under 15K				29.0
4950TW/WPAFB	65807F	84-0221	4008	AMS Installation	91.0			
		83-0310	4012	Dual Freon Test	20.0			
		82-0133	4014	Offices - Flt Line Test Engineers	92.0			
		* 84-0314	5	Monorail, New & Relocate Existing	52.0			
		84-0242	207	Engineering Space	46.0			
		Various	Various	8 Projects each leas than 15K	68.0			
		* 84-0207	5	Modernize Paint Shop		189.0 #		
		* 84-0109	5	Silk Screen/Processing Rooms		86.0		
		Not Assigned	206	Construct Annex		121.0		
		* 84-0204	5	Fiberglass Shop		46.0		
		** Not Assigned	5	Lighting System Upgrade - Shops		90.0		
		** 84-0314	13	Elec, Hyd Shop		151.0		
		** 84-0375	13	Modernize Battery Shop		25.0		
		85-0270	4028	Nose Dock Alteration		150.0		
		* 84-0167	5/13	Office Modules - Shops		48.0		
		83-0340	4004	Upgrade Bldg		36.0		

Under procurement action with committed FY 84 funds.
* Request for waiver from the $200,000 limitation for these separate projects granted per HQ USAF/LEEP messages 251500Z May 84 and 901200Z Aug 84 (Combining Multiple Projects in one Facility).
** Request for waiver from the $200,000 limit for these separate projects will be submitted.

Activity	Program Element		CE Proj No.	Building	Brief Description of Work	Cost 1984	Cost 1985	Cost 1986	Cost 1987
4950TW/WPAFB	65807F	**	84-0304	13	Constr Eng/Tire Storage Area		20.0		
			80-0155	Various	Shower/Restroom Facilities		55.0		
		**	84-0293	5	Mod for Eng Design Space		150.0		
		**	Not Assigned	5	Upgrade Heat Treat/Foundry		65.0		
		**	Not Assigned	5	Enlarge Tool Crib		35.0		
			Various	Various	9 Projects each less than 15K		50.0		
			79-0394	Various	Elec Openers for Hangar Doors			95.0	
			84-0167	4014	Renovate Building			50.0	
			Not Assigned	20	Modify Tech Photo Facilities			20.0	
			Not Assigned	5	Upgrade Div/Branch Offices			70.0	
			Not Assigned	4008	Addition of Office Space			50.0	
			Not Assigned	152	Upgrade Building			70.0	
			Not Assigned	72	Upgrade Entrance - Haz Storage Area			50.0	
			Not Assigned	206	Renovate Annex			108.0	
			Not Assigned	5	Upgrade QA Inspection Area			70.0	
			Not Assigned	4012	Alter Job Control			70.0	
			Not Assigned	5	Construct Engineering Facility			45.0	
			Various	Various	8 Projects each less than 15K			50.0	
			Not Assigned	206	Construct Annex				150.0
			Not Assigned	5	Install Autoclave				50.0
			Not Assigned	5	Upgrade Crane Sys - Mach Shop				30.0
			Not Assigned	20	Modify Tech Photo Facilities				20.0
			Not Assigned	Bass Lake	Construct Survival Equip Facility				50.0
			Not Assigned	4010	Addition to Building				200.0
			Not Assigned	4014	Construct Annex				200.0
			Various	Various	8 Projects each less than 15K				50.0
ASD, WPAFB OH	Multi		Multi	Multi	16 Minor Construction Projects	110.0			

** Request for waiver from the $200,000 limit for these separate projects will be submitted.

1084

1 COMPONENT	FY 1986 RDT&E FACILITIES	2 DATE
AIR FORCE		Jan 85

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AIR FORCE BASE, OHIO	EQUIPMENT INSTALLATION UPGRADE BATTERY AND FUEL CELL LAB, BLDG 18

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
62203F	318-612		300.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation Upgrade Battery and Fuel Cell Laboratory, Bldg 18	LS	1		300.0
Install Mechanical Systems	LS	1		(60.0)
Electrical Power	LS	1		(40.0)
Install Dry Room	EA	1	120.0	(120.0)
Install Battery Isolation Booths	EA	4	20.0	(80.0)
Equipment Costs (Non-Add)				(200.0)
Total Equipment and Installation Cost				500.0
Design Cost (Non-Add)				(50.0)
Minor Construction (Non-Add)	LS	1	100.0	(100.0)

10 DESCRIPTION OF PROPOSED Installation: All work necessary to modify and install equipment to support advanced research and development of high power and high energy density battery and fuel cell technology development.

SPECIAL PURPOSE: To accommodate advanced battery fuel cell research and development.

PROJECT: Install one dry room and four battery research isolation booths, and construct battery and fuel cell research stations. Install mechanical and electrical utilities, including humidity controlled air conditioning and electrical distribution to the research areas.

REQUIREMENT: This project will allow advanced research, evaluation and development of high power and high energy density batteries and fuel cells under proper environmental and safety conditions.

CURRENT SITUATION: Optimum research into battery and fuel cell technologies cannot be realized in the current facility. Lack of humidity control and the need for battery isolation booths for toxic material venting and battery rupture containment restrict the present research opportunities.

IMPACT IF NOT PROVIDED: The development of new battery/fuel cell technologies will be greatly limited, impacting advances in the Space Defense Initiative, air and ground launched cruise missile power systems and guidance controls, and defensive/offensive communication satellites.

1. COMPONENT	FY 19 86 RDT&E FACILITIES PROJECT DATA	2. DATE
AIR FORCE		Jan 85

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Arnold Air Force Station, TN 37389	AEDC Test Cells C-1 & C-2 Vector/Reverse Thrust

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
64755F	390-614	860318	296

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Engine Vecotred/Reversing Exhaust Nozzle C-1 & C-2				296
Attachment of Equipment in Cell C-1 to Support Engine Vectored/Reversing Exhaust Nozzle Testing				(35)
Attachment of Equipment in Cell C-2 to Support Engine Vectored/Reversing Exhaust Nozzle Testing				(2,181)
Acquisition of Equipment for Test Cells C-1 & C-2 (Non-Add)				(261)
Total				2,477

10. DESCRIPTION OF PROPOSED INSTALLATION

Fabricate and purchase equipment items and attach in existing test cells (AEDC C-1 & C-2).

PROJECT: Direct connect turbine engine tests in AEDC Test Cells C-1 and C-2 are required for development and certification of vectored/reversing exhaust nozzle configured turbine engines. New test technology features include development and certification of a metric three dimensional engine thrust stand and development and demonstration of a remotely controlled, variable geometry turbine engine exhaust gas capture/purge system. Testing with a full scale turbine engine equipped with a two dimensional vectored nozzle with reverser will be performed to verify the new test techniques. The duplication in C-1 & C-2 provides AEDC with the capability for concurrent testing of the competing Joint Advanced Fighter Engine (JAFE) configurations.

REQUIREMENT: AEDC Test Cells C-1 and C-2 are to be used to conduct vectored/reversing exhaust nozzle thrust test in support of the Advanced Tactical Fighter (ATF) JAFE program. The extensive build-up (development, demonstration, and validation) is required to simulate the environment, operational mode, and evaluation data needs of the new technology applications projected for the ATF/JAFE aircraft systems.

CURRENT SITUATION: AEDC Test Cells C-1 and C-2 are engine test facilities with basic plant equipment capability. To accomplish the objectives of the JAFE vectored/reversed thrust program, special equipment (diffusers, thrust stands, purge air systems, engine inlet duct systems, instrumentation, and controls) that are not applicable to other types of engine tests are required to support, monitor, and evaluate the test engines.

IMPACT IF NOT PROVIDED: Possible delays in the testing schedule.

1 COMPONENT	FY 1986 RDT&E FACILITIES PROJECT DATA	2 DATE
AIR FORCE		Jan 85

3 INSTALLATION AND LOCATION	4. PROJECT TITLE
Arnold Air Force Station, TN 37389	AEDC Test Cell C-1 Joint Technology Demonstrator Engine

5 PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
64755F	390-614	860316	349

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Attachment of Equipment in Cell C-1 to Support the Joint Technology Demonstrator Engine				349
Joint Technology Demonstrator Engine C-1				(349)
Acquisition of Equipment for Test Cell C-1 (Non-Add)				(788)
Total				1,137

1086

10 DESCRIPTION OF PROPOSED INSTALLATION

Procure equipment items and attach in an existing test cell (AEDC C-1).

PROJECT: Provides for fabrication, purchase, and attachment of test peculiar equipment in an existing test cell at AEDC to support altitude development testing of the Joint Technology Demonstrator Engine (JTDE). A direct connect turbine engine test program in Test Cell C-1 is required to verify and demonstrate the capability for development of advanced fighter-type turbine engines. State-of-the-art test techniques will be used with demonstration configuration turbine engines to assess engine aero/mechanical (stress) characteristics and limitations, steady state and transient performance levels, engine stability margins and post stall behavior, and engine operational suitability at selected extremes within operation (altitude and mach numbers) envelopes for fighter-type engines.

REQUIREMENT: The AEDC program is to obtain timely measurements that demonstrate and validate the capability of Test Cell C-1 to provide full scale system test environmental conditions necessary for minimum risk test assessments of new technology applications.

CURRENT SITUATION: AEDC Test Cell C-1 is an engine test facility with basic plant equipment capability. To accomplish the objectives of the JTDE program, special equipment to support and monitor a direct connect technology engine test is necessary. The equipment needed to support the testing of an engine composed of advanced technology components may not be applicable to other engine tests. Therefore, this equipment is needed to specifically meet the JTDE program test requirements.

IMPACT IF NOT PROVIDED: Possible delays in testing schedule.

1. COMPONENT	FY 19 86 RDT&E FACILITIES PROJECT DATA	2. DATE
AIR FORCE		Jan 85

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Hanscom AFB, Bedford, MA 01731	Addition to Electronic Research Laboratory, Bldg 1302J

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
63250F			2,300

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Addition to Electronic Research		16,450 sq ft	140/ sq ft	2,300

10. DESCRIPTION OF PROPOSED INSTALLATION

Construct an addition of 16,450 sq ft on the roof of Building 1320J, including heating, ventilation, and air conditioning systems, lighting, test and control areas, office, and laboratory areas.

REQUIREMENT: Laboratory space is required for contractor research and development on various DOD and FAA sponsored programs. The new space will be utilized by Air Vehicle Survivability Program. The space provided by the addition will permit the entire program to be housed in one building instead of in three widely-separated areas within the complex. Space vacated by this program will permit the centralization of space provided to several other DOD and FAA programs.

CURRENT SITUATION: Lincoln Laboratory's facilities are furnished by the government to the contractor (MIT) for use in various R&D programs. A number of these programs require additional space to relieve serious overcrowding of laboratories and offices, and to house new design and fabrication personnel and the computer installations used to support their work. Past growth has been such as to preclude the anticipation of specific space needs, particularly as to location. The result has been an overall shortage of space, along with a scattering of facilities devoted to particular programs. This physical separation of individuals who work best in close proximity with each other has led to inefficiencies and delays.

IMPACT IF NOT PROVIDED: Prolongation and aggravation of overcrowded conditions, safety problems, and loss of progress.

1. COMPONENT	FY 19 86 RDT&E FACILITIES PROJECT DATA	2. DATE
AIR FORCE		Jan 85

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Malabar Transmitter Annex, Brevard County, FL	Equipment Installation Malabar Advanced Telescope System

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
64710F	371-475	PA 86-5107B	55

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation				
Malabar Advanced Telescope System	LS			55
Mounting Pedestal	LS			(15)
Halon Fire Suppression System	LS			(40)
Cost of Purchsed Equipment (Non-Add)				(18,200)
Total Equip. & Installation Cost (Non-Add)				21,200
Minor Construction (PA 86-5107A)(Non-Add)				(187)

10. DESCRIPTION OF PROPOSED INSTALLATION

The Malabar Advanced Telescope System consists of a telescope optical assembly, mount, and control electronics. Control electronics include encoders, servoes, and a dedicated computer. The system is being developed and integrated as a package by the contractor (Itek Corp.). The system cost is $18,200,000 and the integration, installation, and check-out is $3,000,000. The project is needed for the support of intelligence collection for DOD. RDT&E equipment and installation is being procured under contract F08606-84-C-0008.

PROJECT: Alterations for installation of the Malabar Advanced Telescope System.

REQUIREMENT: This project is required for the installation of an advanced telescope to be used in support of intelligence collection facilities for DOD.

CURRENT SITUATION: Existing facility was constructed in 1970 to support a Defense Advanced Research Project Agency program which was completed in 1972. The facility was used to support a CIA program from 1975 through 1977 and is currently not being utilized.

IMPACT IF NOT PROVIDED: If construction is not approved, effective intelligence collection will be significantly hampered and the intelligence community will be deprived of much needed information. Delay of project will require Air Force to pay the contractor for storing the equipment until construction is approved.

1 COMPONENT	FY 19 86 RDT&E FACILITIES PROJECT DATA	2 DATE
AIR FORCE		Jan 85

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
Arnold Air Force Station, TN 37389	Equipment Installation Upgrade ARC Heater

5. PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
64755F		DB34VW DB49VW	100

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation				
Upgrade ARC Heater				100
Expanded Flow Nozzle		30		
Test Section with Model Injection System		20		
Exhaust Flow System		40		
Dust Erosion System		10		
Cost of Purchased Equipment (Non-Add)	LS			(1,400)
Expanded Flow Nozzle		500		
Test Section with Model Injection System		400		
Exhaust Flow System		400		
Dust Erosion System		100		
Total Equip & Install Cost (Non-Add)	LS			(1,500)
Other Non-Add Costs	LS			None
Design Cost	LS			(150)

1089

10. DESCRIPTION OF PROPOSED INSTALLATION

This effort provides for the installation support of an arc heater expanded flow system (with dust dispenser system) that is compatible with the High Enthalpy Arc-Heater Test (Heat 1) Unit.

PROJECT: The HEAT 1 Arc Heater Test Unit will be modified to include an expanded flow nozzle, a test section with model injection system and dust erosion system and an exhaust flow system.

REQUIREMENT: The additional testing capability is needed to enable the testing of larger RV areas than just the nosetip and at temperatures beyond current arc heater testing range. Requirements exist for testing RV antenna windows, heat shield, interfaces and lifting bodies. The expanded arc flow environment (to 10" diam) will permit testing in the RV mode and a high Mach (5 to 8) true temperature mode.

CURRENT SITUATION: The existing AEDC segmented arc-heaters have a nozzle diameter of 0.9 inch, is powered by a 60MW power supply which produces model stagnation pressures to 120 atmospheres, enthalpies to 8800 BTU/lb and flow to Mach 2.0. The DOD arc heater facilities have been consolidated at AEDC. NASA/Ames has several arc heaters also without the required testing capability and with less adaptability than the AEDC arc heaters.

IMPACT IF NOT PROVIDED: This center for arc heater testing will be unable to adequately support missile and aircraft testing requirements due to test rhombus size limitation and environmental simulation constraints.

1 COMPONENT	FY 86 RDT&E FACILITIES PROJECT DATA	2 DATE
Air Force		Jan 85

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
Wright-Patterson AFB, OH 45433	Install Fuel System Simulator, Bldg 490

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
62203F	316-632		300.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation, Install Fuel System Simulator, Bldg 490	LS	1	300.0	300.0
Install Mechanical System	LS	1	150.0	(150.0)
Electrical Power	LS	1	75.0	(75.0)
Control System	LS	1	75.0	(75.0)
Equipment Costs (Non-Add)				(850.0)
Total Equipment and Installation Costs				1150.0
Design Cost (Non-Add)				(25.0)

1090

10. DESCRIPTION OF PROPOSED installation

RDT&E WORK: All work necessary to install a fuel system simulator in Rm 144 of Bldg 490 to simulate flow and thermal characteristics of fuels in an aircraft environment.

PROJECT: Install one fuel effects fuel system simulator consisting of oil heaters, inductive heating equipment, wing tanks, fuelage tanks, several heat exchangers, interconnecting piping, valves and associated control system, and supporting electrical power and utilities which will include air, liquid and gaseous nitrogen, water, etc.

REQUIREMENT: Simulator will allow evaluation of fuel thermal properties under actual aircraft conditions and assist in setting fuel specifications and act as a problem solving tool to investigate fuel system problems.

CURRENT SITUATION: Design of the fuel effects fuel system simulator will be complete by April 1984. Fabrication will occur between Apr 84 - Dec 85. Delivery to WPAFB is anticipated in February 1986.

IMPACT IF NOT PROVIDED: The evaluation of fuel thermal properties on new candidate fuels, especially those from alternate sources, will be sharply limited and require extensive and expensive full scale engine testing prior to their introduction into the Air Force fuel inventory.

1 COMPONENT		2 DATE
Air Force	FY 86 RDT&E FACILITIES PROJECT DATA	Jan 85

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
Arnold Air Force Station, TN 37389	Facility Computer & Network Improvement

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65807F		830361	764.7

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation Facility Computer & Network Improvement				764.7
Cost of Purchased Equipment (Non-Add)	LS			(5,620.0)
Total Equipment & Installation Cost (Non-Add)	LS			(6,384.7)
Other Non-Add Costs				
Design Costs	LS			(1,457.8)
Maintenance & Supplies Cost	LS			(2,895.0)
Travel & Consultants	LS			(145.0)
Minor Construction (Project #850373) (Non-Add)	LS			(194.0)

10 DESCRIPTION OF PROPOSED installation

Install central processing units, storage units, peripheral devices and communications networks in the Propulsion Wind Tunnel (PWT) and Von Karmon Facility (VKF) facilities. Interface with existing data acquisition equipment to provide facility computer networks for PWT and VKF.

SPECIFIC PURPOSE: PWT and VKF facility computer rooms must be modified to comply with DOD Security Standards as required to support classified processing of test data.

REQUIREMENT: Replace existing Category I computing facilities for PWT and VKF with modern equipment, including central processors, peripherals and communication devices which can connect to the AEDC classified and unclassified networks.

CURRENT SITUATION: The existing Category I computational facilities are currently inadequate to maintain the required pace of testing in the PWT and marginally adequate for VKF. The manufacture of the central processor was discontinued in 1976, and upgrades of the operating system software was discontinued in January 1981.

IMPACT IF NOT PROVIDED: Failure to provide modern equipment will seriously curtail the development and implementation of improved test techniques and process automation. Failure to implement the proposed interfacility network will result in test delays caused by single point failures in the facility system.

1 COMPONENT		2 DATE
Air Force	FY 86 RDT&E FACILITIES PROJECT DATA	Jan 85

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
Arnold Air Force Station, TN 37389	Engine Test Facility/Facility Computer Upgrade

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65807F		850188	1345

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation	LS			170
Materials				1175
RDT&E Equipment/Hardware (Non-Add)				(6540)
Total (Equipment & Installation)				(7885)

1092

10 DESCRIPTION OF PROPOSED installation

PROJECT: The Engine Test Facility (ETF) facility computer is used for conversion of raw data from the propulsion test units to Engineering Unit Data (EUD) and limited processing to provide test personnel with information in near-real time necessary for effective test direction. This improvement includes replacement and/or upgrade of the ETF facility computer system, including perpherals, interactive terminals, and other equipment necessary to present timely information to users in an effective format.

REQUIREMENT: The increased sophistication, complexity, and performance of test articles, and the necessity for reducing operational costs require improved facilities in the ETF for the support of data reduction and analysis. In addition to projected increases in data volume, escalating requirements for providing partial results in near-real time and for comparison of experimental results with the predictions of computer models of the test article and increasing levels of automation in the testing process are expected to require still further increases in computational capacity.

CURRENT SITUATION: The present facility computer is a Digial Equipment Corporation (DEC) KL10, which was purchased in 1983, as an interim upgrade. By 1986 this system will be only marginally capable of performing its mission. A dual VAX-11/780 system to be installed to support MX testing in the J4/J5 complex and the computer system to be installed in ASTF, which includes a CRAY-1S Vector Processor will be available part of the time to augment the capabilities of the facility computer.

IMPACT IF NOT PROVIDED: Possible degration of the mission.

1 COMPONENT		2 DATE
Air Force	FY 86 RDT&E FACILITIES PROJECT DATA	Jan 85

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
Wright-Patterson AFB, OH 45433	Equipment Installation Top Secret Computer Facility

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65806F	311-173	EO 82-9135	(592) 440.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation (EEIC 592)				
Top Secret Computer Facility				440.0
Electromagnetic Shielding	SF	2,500	48.0	(120.0)
Raised Flooring	SF	825	30.3	(25.0)
Secodary Utilities	LS			(100.0)
Equipment Air Conditioning	LS			(60.0)
Halon Fire Protection	LS			(25.0)
Demountable Partitions	LS			(20.0)
Security Alarms	LS			(90.0)
Cost of Purchased Equipment (Non-Add)	LS			(650.0)
Total Equip & Installation Cost (Non-Add)				(1090.0)
Other Non-Add Costs				
Design Costs				(25.0)

1093

10 DESCRIPTION OF PROPOSED installation

PROJECT: Installation of a computer facility to process Top Secret data to support the in-house development planning analysis capability. Within existing vault space in Bldg 47, provide raised computer flooring, electromagnetic shielding, secondary utilities, Halon fire protection, security alarms and demountable partitions to provide a complete and usable Top Secret data processing facility. A secure work area will be located immediately outside the Class A vault.

REQUIREMENT: A Top Secret data processing facility and adjacent secure work areas to support their future Development Planning mission. Development planning analysis studies are becoming increasingly complex, thus requiring very high reliance on computers and since they involve an ever increasing amount of classified information and special access projects, strict security requirements must be met. This computer supports long range planning objectives and is responsible for development planning studies such as the Mobility Mission Analysis (MMA) and the Trans-Atmospheric Vehicle (TAV) Concept Definition Study.

CURRENT SITUATION: Presently there is no computer facility available that can provide the Top Secret data processing, storage capability and adjacent secure work areas required to perform the mission outlined above. This project will provide a government owned and operated facility to insure an effective, secure operation.

IMPACT IF NOT PROVIDED: Inability to perform many anticipated and critical development planning studies without the use of a Top Secret computer facility. Without this facility, full, effective accomplishment of the mission is not possible.

1 COMPONENT	FY 1986 RDT&E FACILITIES PROJECT DATA	2 DATE
AIR FORCE		Jan 85

3 INSTALLATION AND LOCATION	4. PROJECT TITLE
MIT-Lincoln Laboratory Millstone Hill Radar, Westfield MA	Extension to L-Band Transmitter High-Bay Area

5 PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
12424F			332

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Extension to L-Band Transmitter High-Bay Area				
Structural	SF	2720	74.00	201.4
Architectural	SF	2720	37.39	101.7
Electrical	SF	2720	4.63	12.6
Sub-Total				315.7
Contingency (5%)				15.8
Total Funded Cost				331.5
Total Request (Rounded)				332.0

10. DESCRIPTION OF PROPOSED INSTALLATION

Description of Proposed RDT&E Work: Extend present transmitter High-Bay Area at the Millstone Hill Radar to accommodate a back-up L-Band Transmitter including heating, ventialtion and air conditioning systems, lighting and control areas.

Requirement: Increased high-bay area is required to house a back-up L-Band Radar Transmitter to support contractor research and development in the Satellite Tracking Program.

Current Situation: Lincoln Laboratory is engaged in the research and development of satellite tracking techniques at the Millstone Hill Radar site. A second high voltage L-Band Radar Transmitter is required as a backup to the prime mission transmitter and as an adjunct to increase the average poser and sensitivity. The second Transmitter which has been warehoused nearby must be colocated with Transmitter #1. The proposed addition will increase the size of the transmitter area allowing safe installation of the second high voltage transmitter.

Impact if not Provided: Failure to provide the space will result in the continuation of non-scheduled downtime and the inability to develop increased sensitivity schemes.

TO BE PROVIDED LATER